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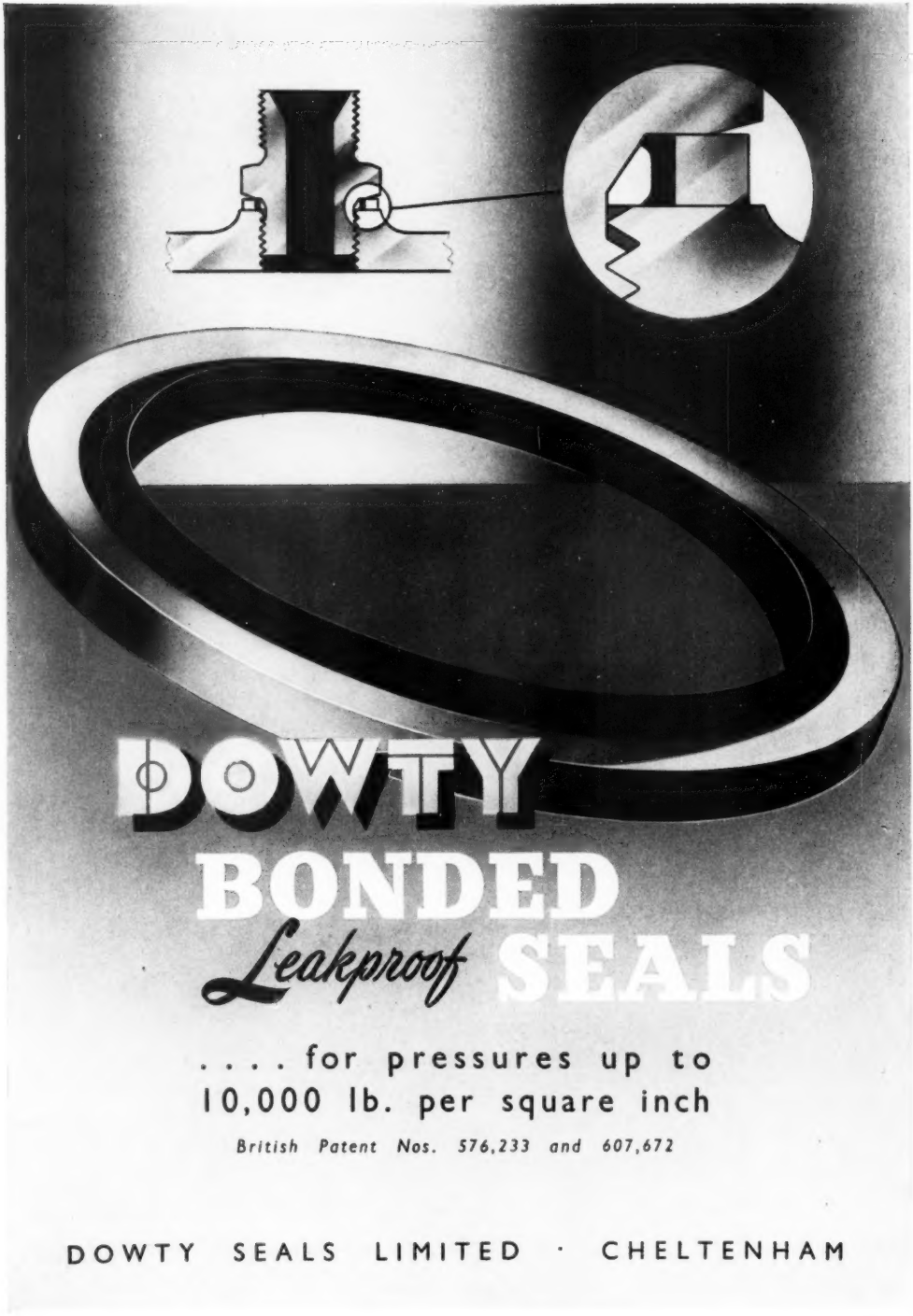
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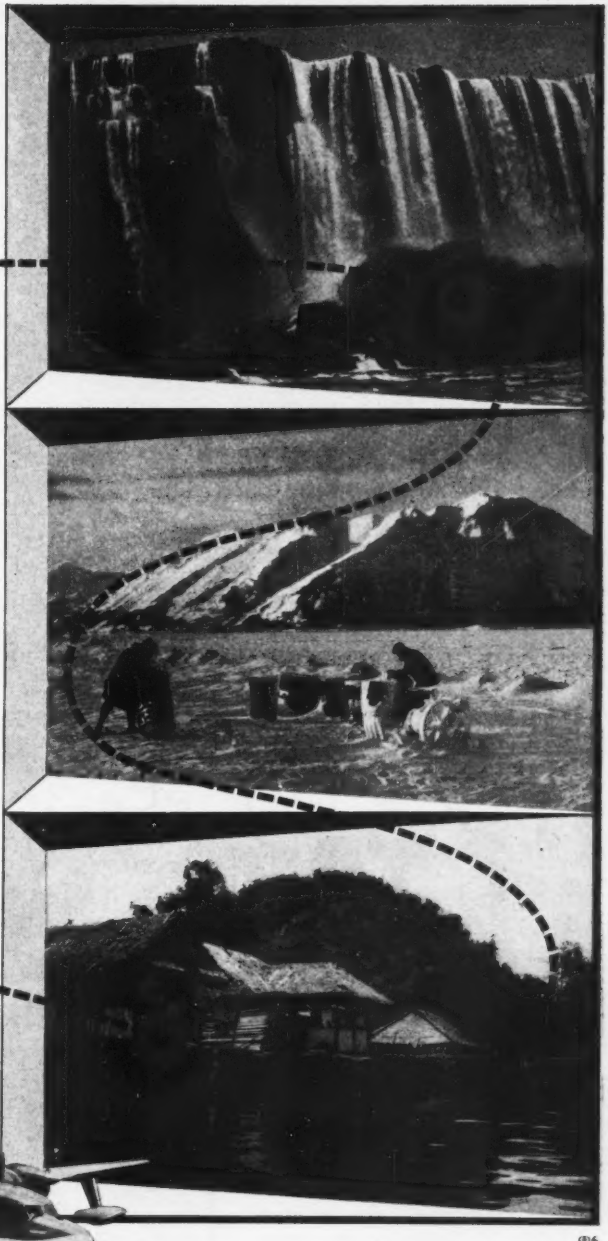

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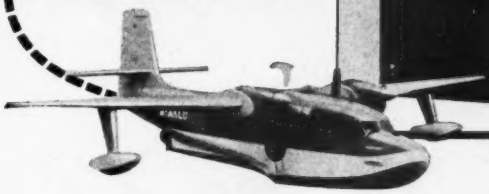

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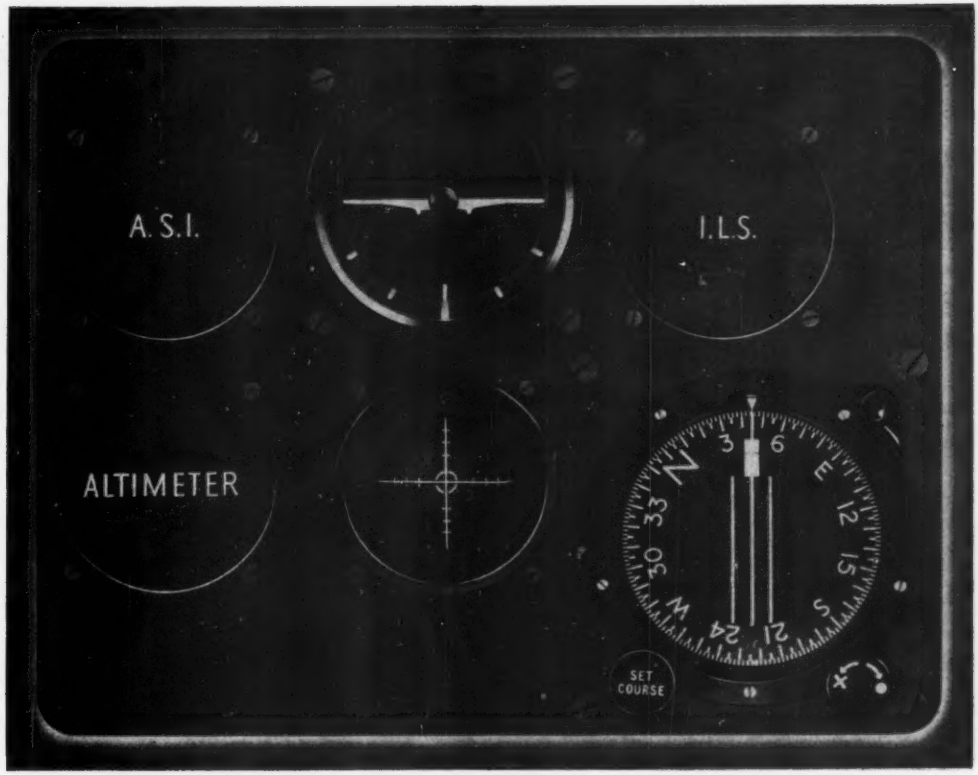

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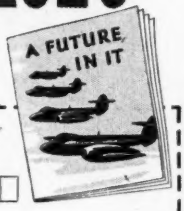

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No. 2230 Vol. LX. FRIDAY, 19 OCTOBER 1951

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STAMFORD STREET,
LONDON, S.E.1.

Telegrams, Flightpres, Sedist, London.
Telephone, Waterloo 3333 (60 lines).

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Two-way Traffic—

TO America we "Britishers" owe a great deal. Not least are we indebted to her aircraft designers for keeping their opposite numbers in this country on their toes, and to many of her constructors for freely disclosing vital manufacturing techniques which might have been prohibitively expensive in terms of our own time and money.

Never has Anglo-American technical rivalry been keener or co-operation closer than at the present time, though collaboration is not, as is often supposed, of recent growth. Over thirty years ago, during the Kaiser's war, the Handley Page 0/400, D.H.4 and S.E.5 were being built in American factories, and the American Liberty engine remained in continuous service with the R.A.F. from 1918 to the early 1930s. To America, also, we acknowledge some of the best of the R.N.A.S. flying-boats, in the development of which the Englishman John Porte was largely concerned.

In later years, the Curtiss D-12 engine, anglicized as the Fairey Felix and installed in the Fox biplane, gave the R.A.F. the world's fastest bomber. This Felix-Fox, it may be remarked, was as outstanding a combination in its day as the Merlin-Mustang of 1943, or, to cite more recent instances, the Shooting Star with the Whittle jet, the Sapphire-Thunderjet, or the Avon-Sabre.

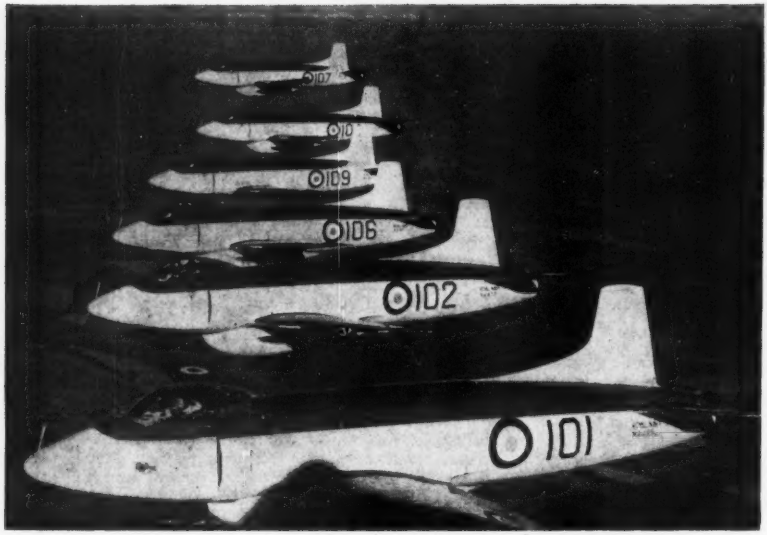
The most pleasing aspect of this traffic in equipment and ideas is that it has not been one-way; or at least it has never remained so for long. To-day we see the Armstrong Siddeley Sapphire-powered English Electric Canberra bomber in production at the Martin plant, while at Lockheed, R.A.F. crews prepare to deliver to Coastal Command the first of a batch of Neptune patrol bombers. We see the excellent Sabre airframe wedded to the highly promising Orenda jet, and the versatile Canadian Beaver adopted—with the greatest enthusiasm—by the American armed forces; and we see not only the Sapphire but the Rolls-Royce Tay on American production lines, and licences secured for other British gas turbines, both of the turbojet and turboprop variety, of Armstrong Siddeley and Bristol design.

—an Increasing Flow

Nor is there any sign that the limit of collaboration and interchange has been reached; in fact, having proclaimed the Hawker P.1067 and Vickers Valiant as the pre-eminent fighter and bomber in their respective classes, influential American journals are now openly discussing the possibility of one or both of these types being built in the U.S.A. That this is not idle gossip is borne out by Mr. W. T. Gill, President of the Society of British Aircraft Constructors, who recently told a Washington journalist that he had no doubt that the matter would be discussed during his present visit to America. (As reported on page 500 of this issue, Mr. Gill, in company with British and American officials, is engaged on a month's tour of American and Canadian factories and military centres.)

In answer to one specific question, Mr. Gill is on record as saying that he saw no reason why the Valiant and other British types should not be built in the U.S.A., adding that the interchange of aircraft types would be in line with the aims of the North Atlantic Treaty Organization.

Now that national prejudice has largely been removed and no stigma need attach to the adoption of a "foreign" aircraft or engine, the two nations must ensure that the finest equipment procurable is produced in the most efficient and economical manner for the common good. This does not mean that the perils of over-standardization must be risked, for to-day, more than ever before, it is vital that a healthy stream of competitively designed prototypes should be flowing to our experimental establishments and proving grounds. And though we have here confined our observations to Great Britain and America, we are not unmindful of the claims and potentialities of the industries of France, Italy and Holland. Even as this is written comes the news that U.S.A.F. pilots have been flying French prototypes.



"FLIGHT" PHOTOGRAPHS

Not, perhaps, a perfect echelon but a pretty good one nevertheless. Which, one may ask, is "odd man out"?

NO. 800 SQUADRON

The First Operational Naval Unit to be Equipped with Jet Aircraft

WHEN, in 1918, the Royal Naval Air Service and the Royal Flying Corps were merged to form the Royal Air Force, the Admiralty lost control of naval flying, and all air units working with the Navy were placed under the control of R.A.F. Coastal Area. The Admiralty were fully alive to the many anomalies of this system, and the first result of their attempt to regain some measure of control was the creation of the Fleet Air Arm in 1924. Naval aircraft continued, nevertheless, to be flown by R.A.F. pilots, with naval men in the rear cockpits: thereafter, under continued Admiralty pressure, it was eventually agreed that some naval pilots should be used, and considerably later the decision was taken that upwards of 70 per cent of Fleet Air Arm officers should be naval officers. The Admiralty did not, however, succeed in achieving their aim of complete control of the Fleet Air Arm until July, 1937, and even then it took nearly a further two years for the Fleet Air Arm truly and wholly to become a part of the Navy.

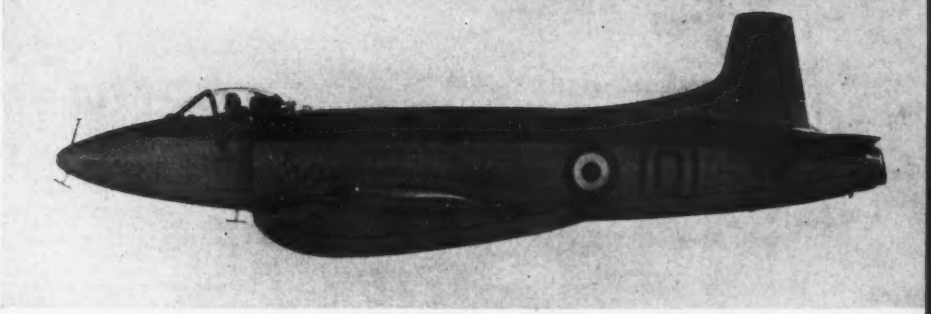
This historical sketch is given in order that the beginnings of the squadron with which we are here concerned may be studied in the right perspective. It was decided in 1930 that the flights of the Fleet Air Arm should be regrouped into squadrons, these to be numbered from 800 onward: thus it was that Nos. 403 and 404 Flights were re-formed in 1931 to make the first naval air squadron—No. 800. That this squadron should be the first operational unit in Naval Aviation to be equipped with jet aircraft is, therefore, only fitting.

The very fact that 800 is the first operational jet squadron in the Navy means that to some extent its preliminary work must be of an exploratory nature, and later jet squadrons will reap the benefit of 800's trials and errors. Such prototype work demands workers of more than ordinary ability and, in its wisdom, the Admiralty has selected for the squadron a group of pilots of above-average calibre. The squadron Commander is Lt. Cdr. G. C. Baldwin, D.S.C. and Bar, R.N., who, in addition to a most distinguished war career, during which he attained to the command of No. 4 Naval Fighter Wing, also took the Empire Test Pilots School course, served for two years in the Service Trials Unit acted as liaison officer to the Central Fighter Establishment at West Raynham (during which time he flew with the Air Fighting Development Squadron) and finally, prior to assuming command of 800 Squadron, took the Royal Naval Staff course at Greenwich.

The senior pilot of the squadron is Lt. D. R. O. Price, D.F.C., R.N., whose "potted biography" has already appeared in *Flight* (November 24th, 1949) in connection with the work of 809 Night Fighter Squadron, of which he was also senior pilot. Before leaving 809 in October last year, Lt. Price took the Jet Conversion Course at Culdrose, and then served in the Battle-class destroyer H.M.S. *St. James* for eight months, the final three of which he put in as "Jimmy the One." Having "balanced his career" somewhat with watch-keeping experience in a ship, he renewed his green ticket on jet aircraft at Culdrose before taking up his present appointment.

Second senior to Price in 800 Squadron is Lt. A. B. B. Clark, R.N., who, following on a busy war, had two and a half years in

This view of one of 800's Attackers being serviced shows to advantage the flaps and wing-lift spoilers. Note, in the bay forward of the Nene, the integral funnel on the fuel filler-pipe.



The C.O. of the squadron poses his Attacker to show the difference the long-range tank makes to the aircraft's profile.

the Service Trials Unit prior to joining 801 (Sea Hornet) Squadron. In the middle of 1947, Lt. Clark went to America with 806 Squadron Aerobatic Demonstration Team, and in April, 1948, was, as commanding officer, responsible for forming 702 Squadron as the Naval Jet Evaluation and Training Unit at Culdrose. As all the pilots of 800 Squadron, with the exception of the C.O., undertook the Jet Conversion course, Lt. Clark has had the surely unique experience of having been the commanding officer at some time or another of everyone of his squadron colleagues.

This is not the place for even synoptic career histories of all the pilots in 800, but we should mention Lt. D. M. Rouse, R.N., who, immediately prior to joining the squadron, had a spell of duty at the Naval Air Fighter Development Unit, West Raynham, and also served as an executive officer for three months in the destroyer H.M.S. *Scorpion*. Another pilot, Lt. A. R. Rawbone, A.F.C., R.N., was mentioned in despatches during the war, became senior pilot of 809 Squadron and, after the war, was appointed an instructor at the Operational Fighter School, Rattray. After taking the C.F.S. course, he served as an instructor at various naval establishments, and then, for over two years, at C.F.S.: in that he obtained a King's Commendation and the A.F.C. for his work as an instructor, it is not to be wondered at that his instructor's category is A.1. Perhaps the best indication of pilot quality in the squadron is given by the fact that individual flying experience averages 1,700 hours—an unusually high figure for fighter pilots. There is little doubt that the norm which 800 will set for future squadrons will be high.

Naval squadrons are disbanded and re-formed rather more freely than are their complementary units in the R.A.F., and 800 is no exception to the general rule. Unfortunately, the early history of the squadron is obscure, as the records were lost when *Indomitable* was bombed in the Mediterranean in 1941. However, it is known that in 1934-35, the aircraft complement was eight Nimrods and three Ospreys, and that at about this time the squadron was shore-based at Eastleigh.

In 1938, they moved to Worthy Down, and whilst there became a Royal Naval unit. At about this juncture, the squadron was split, "A" Flight remaining as 800 Squadron, and "B" Flight being re-formed as 803 Squadron. At the outbreak of war, 800 had Skuas, and were embarked in *Ark Royal*. They took part in the invasion and occupation of Norway, attacks on Trondhjem, and bombed the *Scharnhorst*. In 1940, the squadron was at Oran, then Mers-el-Kebir, Dakar, and covering Malta convoys. They were relieved in *Ark Royal* in October, 1940.

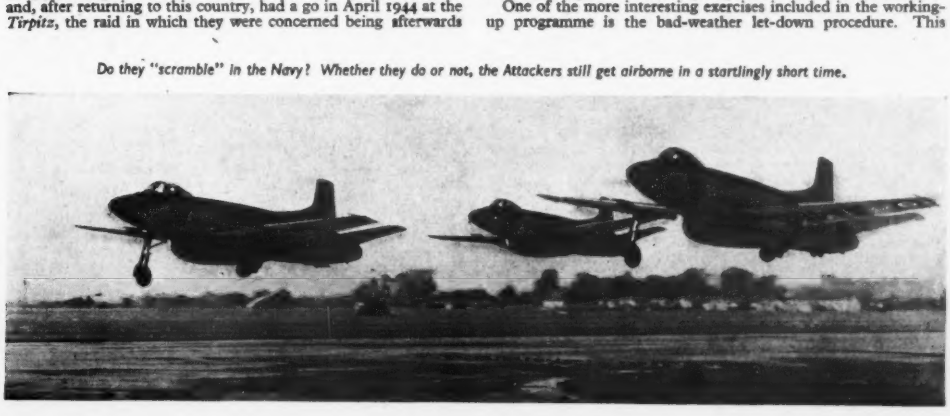
With Hurricane 2Bs, they were embarked in H.M.S. *Biter*, in 1942, and covered the Oran landings. Re-equipped with Hellcats in 1943, the squadron made a trip to Norfolk, Virginia, in *Emperor* and, after returning to this country, had a go in April 1944 at the *Tirpitz*, the raid in which they were concerned being afterwards proved successful. A few months later, they sailed for the Mediterranean, and took part in the landings on the south coast of France, following which they had a spell in the Aegean, clearing Germans from the Greek islands. After returning to England, to re-equip with Hellcat 2s, the squadron (now with 30 pilots and 24 aircraft) re-embarked in *Emperor* and sailed for the Far East to cover the occupation of Rangoon. Back in the U.K. in October, the squadron was disbanded only to be re-formed in September the following year (1946) with Seafire 17s. In February, 1947, embarked in *Triumph*, the squadron sailed for Malta, and later escorted H.M.S. *Vanguard* in which the Royal Family were returning from their African tour. From this time until April, 1949, when the squadron came back to Donibristle and re-equipped with Seafire 47s, they stayed with *Triumph* in the Mediterranean, returning there in the same ship immediately after re-equipping.

In the autumn of 1949, 800 went out with *Triumph* to the Far East, and from October until February periodically engaged in strikes against Malayan bandits. When the Korean campaign started in June, *Triumph* was ordered to Okinawa, and the wonderful job which the ship, and 800 Squadron with her, did in Korean waters is now history. Suffice it for us to say that 800 Squadron alone made 360 sorties, 245 on combat air patrol, and 115 on strikes. It must, in addition, be a source of satisfaction to everybody concerned that two of the pilots who served with 800 in Korea, Lt. R. C. Fluker and Commissioned Pilot A. R. Warren, are still with the squadron.

After being disbanded out of *Triumph* when the ship came home from Korea, the squadron was re-formed at Ford in its present guise on August 22nd last, and one week later the final two Attackers arrived to make up the full complement of eight plus one (reserve) aircraft. Since commissioning, the squadron has been engaged on a working-up programme with a target of 1,300 hours by March 14th. The programme is, of course, based on the squadron's rôle of high-altitude interception with emphasis on all-weather operation and, as such, involves navigation at high speed and high altitude, air-to-air firing, and general high-altitude fighter tactics. Later on, the work will involve addles (airfield dummy deck landings) prior to the squadron embarking for deck-landing training in *Illustrious*. So far, 350 hours of the training programme have been completed, but in fact the squadron have done rather more flying in their Attackers than this figure would indicate, as they have contributed largely to the success of several naval air displays in various parts of the country. In addition, together with three pilots from West Raynham, two 800 pilots (Rouse and Searson) flew Attackers round the course immediately prior to the *Daily Express* Air Race last month.

One of the more interesting exercises included in the working-up programme is the bad-weather let-down procedure. This

Do they "scramble" in the Navy? Whether they do or not, the Attackers still get airborne in a startlingly short time.



NO. 800 SQUADRON . . .

differs from that which will be used in conjunction with a carrier, in that the procedure is based on V.H.F. D/F. rather than radar. It is, however, the let-down through bad weather which is the vital element of the practice. In this exercise, the squadron are homed over the airfield at 25,000ft and fly in loose line-astern. When told to do so by the ground controller, the flight leader turns 90 deg to starboard, the remaining numbers of the formation doing precisely the same at ten-second intervals. On turning, the aircraft is throttled fully back and, with dive brakes out and at 250 kt I.A.S., descends at approximately 8,000ft/min. One minute after breaking away, the leader again turns through 90 deg to starboard, telling the other members of the squadron when he does so; the rest follow through the manoeuvre at 15-second successive intervals. This brings the squadron in rough line-astern on a reciprocal to their original course. Thereafter, the ground controller turns them individually into the "safety lane" and reduces them to about 300ft, from which height visual landings are made. The safety lane, incidentally, is a 20-deg arc from the airfield out to sea and clear of obstructions.

On the whole, the pilots of 800 like their Attackers quite well but, perhaps because they are a bunch of unusually experienced men, their appraisal of the aircraft is rather more objective than might otherwise be the case. They are (quite rightly) conscious that the Attacker is not exactly a new aircraft. On the score of flying characteristics, they have few adverse criticisms; the controls are rather heavy at medium speeds, but stick response improves considerably in the higher part of the speed range. The new flat-sided elevators are expected to improve matters somewhat. In general layout, the cockpit is good, and the field of view is excellent; a general criticism, however, is that although the cockpit heating is adequate up to 20,000ft, it falls off above this altitude and the cockpit becomes uncomfortably cold. The front screen keeps reasonably clear from misting, but the flanking bow screens have a pronounced tendency to become obscured and it is the practice to land with the bubble canopy open. Misting and icing when descending from high altitude are problems with the majority of fighters.

The only other adverse criticisms of the aircraft were that small tanks in the wings and fuselage tend to leak; the main tanks, however, are quite free from this trouble. The 250-gallon belly tank is something of an incubus, in that the performance—particularly climb—suffers, although the handling characteristics are not affected. That climb should suffer is, of course, understandable enough, when one reflects that the Nene is given an extra ton to push skyward.

No. 800 Squadron, whether they are conscious of it or not, are the precursors of a new era in Naval Aviation. They are destined, together with another Attacker squadron, and a squadron each of Firebrands and Gannets, to embark next year in the great new carrier, H.M.S. *Eagle*. In wishing them well, we are confident that No. 800 will remain the First Air Squadron in the Royal Navy.

FROM ALL QUARTERS

"Surprise Packet"

THE army manoeuvres this year culminated in a special exercise in which the Royal Air Force and Naval Aviation both took part, 80 aircraft from 2nd T.A.F. in Germany assisting.

Code-named "Surprise Packet," the exercise had as its basis the supposition that England and Scotland were the southern part of an Anglian peninsula. In the extreme south was a democratic power called Southland, with its northern frontier stretching from Bristol to Bishop's Stortford in Hertfordshire. Midland was a buffer state to the north, and in the extreme north, beyond the 54th parallel, was the authoritarian state of Fantasia. Fantasia's aggressive intentions included the capture or destruction of the atomic pile at Broad Hinton, near Marlborough.

Complications were superimposed by imagining a revolt in Midland—instigated by Fantasia—which resulted in Midland refusing to join the United Nations in their effort to stop Fantasia's aggression, and becoming instead Fantasia's ally.

The first phases of the exercise included considerable use of paratroops. Despite an assumed air superiority by Midland and Fantasia, Southland moved strong forces by road during daylight—a manoeuvre which might spell disaster in actual warfare.

Salisbury was "bombed" early on the morning of October 12th and its roads rendered impassable to Southland armour moving up to the Midland frontier. Members of the Civil Defence organization were called out.

An account of the exercise will be given next week.

H.M.S. "Theseus" in Korea

THERE is a strong Hornblower flavour about the exploits of H.M.S. *Theseus* in Korea, as recounted by Capt. A. S. Bolt, D.S.O., D.S.C., R.N. (formerly her Captain; now Director of Naval Air Warfare), before the Royal United Service Institution on October 10th. Much of the *Theseus* story has already been chronicled in *Flight*, notably in the issue of June 8th, 1951; but Capt. Bolt had much of new interest to relate.

Of the general conduct of flying operations he recalled that 23 Sea Furies, 12 Fireflies and one Sea Otter or helicopter were carried. It was found that 2½-hr sorties were desirable, and that 45-gal drop-tanks, and 55-gal nacelle tanks, should be carried by Sea Furies and Fireflies respectively. Wind-speed requirements for aircraft so fitted, and carrying armament stores, necessitated the catapult being used for all launches; and when the catapult failed for a short period R.A.T.O.G. had to be employed. Sea Furies with two 500 lb bombs and drop-tanks needed a 28kt wind down the deck for catapulting. Because 22½ kt was about the maximum for *Theseus* (needing her bottom scraped) and because, more often than not, winds were liable to die down to almost nothing, it was decided to load the Sea Furies with R.P.s and leave the bombing to Fireflies.

In six and a half months of operations, excluding a break of three weeks at Hong Kong, a total of 3,489 operational sorties were flown. It was found that 50 sorties per day was a desirable flying target for five 2½-hr details, although when an extra effort was required it was possible to increase this, and on one day 66 sorties were flown. This high rate was achieved only by good drill. Every man learned what was required of him, and servicing, re-arming and aircraft-handling were always conducted at a satisfactory speed even when temperatures were below freezing point on the flight deck. The deck-landing accident rate was kept at "an extremely low figure".

Two-and-a-half-hour details allowed adequate time for refuelling and re-arming, but there were frequent occasions when an aircraft requiring an emergency landing necessitated the machines prepared for the next sortie to be spotted forward. Since the wings of Sea Furies and Fireflies were not folded with bombs and rockets in place, these landings were liable to throw the planned programme out of gear. (Capt. Bolt pointed out that the U.S. Navy Corsairs do not suffer from this drawback: bomb-carriers are fitted under the inner-wing panels and wing-folding is sufficiently robust to withstand the extra weight of armament.)

S.B.A.C. Mission

AT the invitation of the Aircraft Industries Association of America, Inc., a party of S.B.A.C. members, headed by Mr. W. T. Gill, president of the Society and financial director of Rolls-Royce, Ltd., is engaged on a one-month tour (October 4th to November 4th) of American and Canadian factories and military centres. The party is composed of the following members :—

Sir Roy Dobson, C.B.E., deputy president of the S.B.A.C. and managing director of A. V. Roe and Co., Ltd.; E. C. Bowyer, director of the S.B.A.C.; B. W. A. Dickson, director and general manager, Vickers-Armstrongs, Ltd.; W. R. Verdon Smith, joint managing director, Bristol Aeroplane Co., Ltd.; C. C. Vinson, joint assistant managing director, Fairey Aviation Co., Ltd.; Rear-Admiral M. S. Slattery, C.B., managing director, Short Brothers and Harland, Ltd.; E. Sayers, head of aeronautical sales, British Thomson-Houston Co., Ltd.; S. E. Clotworthy, a director of the Northern Aluminium Co., Ltd.; D. A. Tomlinson, secretary and financial manager, Rotol, Ltd.; Air Marshal C. W. Weedon, C.B., C.B.E., Controller of Engineering Equipment, Air Ministry; and A. Cdre. A. W. B. McDonald, C.B., A.F.C., Officer Commanding Aeroplane and Armament Experimental Establishment, Boscombe Down.

Accompanying the party are the following:—

Maj.-Gen. William Morgan (Commanding General, Western Air Procurement District, Los Angeles); Brig.-Gen. John W. Sessums (Air Research and Development Command, U.S.A.F., Baltimore); Brig.-Gen. Walter Bain (Air Matériel Command, Wright-Patterson A.F.B., Dayton); Capt. Mac C. Wells (Air Matériel Command, Wright-Patterson A.F.B.); Lt.-Cdr. Alan Rothenberg (Bureau of Aeronautics, U.S. Navy, Washington); Admiral D. C. Ramsey, U.S.N. (Rt.) (President of A.I.A., Washington); Capt. L. D. Webb, U.S.N. (Rt.) (Vice-president and Western Region Manager, A.I.A., Los Angeles); and Mr. Burton E. English (Assistant Director of Public Relations, A.I.A., Washington).

The planned itinerary (much of which has already been covered) is as follows:—

October 8th, Washington, D.C.; 9th, Fairchild and Martin; 10th, Curtiss-Wright and Bendix; 11th, United Aircraft and Grumman; 12th, General Electric; 13th, N.A.C.A.; 15th, Alcoa and Thompson Products; 16th, Air Matériel Command (Wright-Patterson A.F.B.); 17th, McDonnell, Allison and Westinghouse; 18th, Consolidated-Vultee, Fort Worth; 22nd, Lockheed and Douglas; 23rd, North American; 24th, Douglas,

Long Beach; 25th, Consolidated-Vultee, San Diego; 26th, Edwards A.F.B.; 29th, Boeing, Seattle; 30th, Vancouver; 31st, Calgary; November 1st, Winnipeg; 2nd, Toronto; 3rd, Montreal; 4th, New York.

Reference to a Press interview in Washington is made in the leading article in this issue. On that occasion Mr. Gill confirmed that, short of a complete national emergency, production of civil airliners would continue in Britain. He had no doubt that Comets could be delivered to foreign buyers, and Mr. Bowyer pointed out that U.S. orders for this type would probably receive special treatment because of Britain's need for dollars.

Mr. Gill declined to answer a question as to whether he thought direction of labour would be necessary to keep the British rearmament drive going, but he did say, "We are no more in favour of compulsory direction of labour than anybody else." Mr. Bowyer pointed out that in June 1950 the British Aircraft Industry employed some 150,000 workers, and said he expected this total to be expanded to some 310,000 by 1953. Both Mr. Gill and Mr. Bowyer affirmed that the success of the expanding British aircraft programme depended to a considerable extent on obtaining adequate supplies of machine tools, of which the U.S.A. must supply part. In regard to labour supply and machine tools, they said, the industry was coming increasingly to rely on sub-contracting and, in an effort to "take the job to the available labour supply rather than bring labour to the job," some of the work was already being done on the Continent. Mr. Gill added that European assistance had been more in the direction of tool production and jigging rather than in actual production of fabricated parts.

Mishap to a Short Glider

THE existence of an experimental glider built by Short Brothers and Harland, Ltd., is revealed by the news that Tom Brooke-Smith, their chief test pilot, was involved in an accident while flying it last Sunday. The glider was being towed-off from Aldergrove by one of the company's aircraft when the mishap occurred. Though the glider suffered considerable damage, Brooke-Smith's injuries were fortunately slight.

Elizabethans—Further Postponement

A B.E.A. announcement states that unfortunately it has not been possible to carry out certain small but fairly important modifications found to be desirable during the period of trial operation with the Elizabethan class aircraft in time to introduce regular services on October 21st—the date provisionally planned. The trial London-Paris services were completed on the 15th, and it has now been decided that the ventilation system, originally designed for the 40-seat layout, requires modification to suit the 47-seat arrangement. The radio installation needs minor alteration, and the Centaurus engines, originally running on the hot side, are now over-cooled : a worth-while reduction in drag (and increase in performance) can be achieved by adjustments to the cowlings and scoops. In view of the seasonal drop in traffic, the present is considered a suitable time for attention to the new fleet.

Jet Patents Settlement

NEGOTIATIONS which have lasted about three years have culminated in an agreement by which Power Jets (Research and Development), Ltd., will receive $4m (about £1,428,600) from the United States Government in full settlement of claims for American use of the Whittle gas-turbine patents.

During the war America was allowed to exploit the patents free of charge for the duration of hostilities; soon afterwards, a token payment of $800,000 was made, without prejudice to future British claims. The new agreement brings this sum up to the $4m mentioned above, and will cover the use of some 200 patents over the next 20 years.

An original claim for $10m was subsequently halved in view of the fact that a number of U.S. engine firms were making licence-payments to British gas-turbine manufacturers.

In 1948 the Royal Commission on Awards to Inventors granted Air Cdre. Sir Frank Whittle £100,000 free of tax. He had previously refused to make any claim, on the grounds that he had been a serving officer at the time.

"Shep" Hands Over at Hucknall

A TEST pilot who has flown for 35 years, logging some 8,000 hours on 77 different types, is now about to exchange the pilot's seat for an office chair. He is Capt. R. T. Shepherd, O.B.E., who has been chief test pilot to Rolls-Royce, Ltd., for 16 years and who was, in fact, the first test pilot to be employed by them.

"Shep" was the first man to fly behind a Merlin—destined to become such a famous power unit—and he has also been responsible for the flight testing and development of the Buzzard, Kestrel, and Griffon, as well as for the Rolls-Royce turbojets. He flew the Nene-Lancastrian at the S.B.A.C. Display in 1946 and later, with aviation correspondents as passengers, he demonstrated the possibilities of jet propulsion for civil aviation. His skill as a pilot was exceptional and his polished display with the reheat Derwent Meteor at the 1949 Display will long be remembered by those who saw it.

THE HUCKNALL TEAM : Though, as reported on this page, Capt. R. T. Shepherd (left) is now to act in a consultative capacity to the Rolls-Royce management, he will not be giving up active flying entirely. With him are seen (left to right), A. J. Heyworth, D.F.C., W/C. A. McDowell, D.S.O., A.F.C., D.F.M., F/L. H. C. Rogers, D.F.C., and—succeeding "Shep" as chief test pilot—W/C. J. H. Heyworth, A.F.C.

Capt. Shepherd has now been appointed to the post of flying consultant to the management, and his long experience of engine flight-development will clearly be of great value. He will, however, continue to fly as and when occasion demands.

W/C. J. H. Heyworth, A.F.C., will take over the position of chief test pilot, with S/L. H. N. D. Bailey as assistant chief test pilot. A photograph of the "Hucknall team" appears above.

Lord Ogmore in Holland

SPEAKING at the Hague during his recent visit to Holland, Lord Ogmore, Minister of Civil Aviation, remarked that so young was the industry that some of the pioneers of aviation were still with us. For example, Dr. Plesman, founder of K.L.M., was still its active president. To place this fact in full perspective, he added, we should remember that K.L.M. was the oldest continually operating air carrier in the world.

After signifying his pleasure at all he had seen at Schiphol Airport, and thanking Mr. Dellaert, Schiphol's manager, for being a most useful delegate at the conferences of Western European Airport authorities, the Minister said that people now regarded the air as a natural means of travel. Recently, he continued, he had crossed the English Channel in a Freighter aircraft on the service which is ferrying cars and their passengers between England and France. Throughout the summer these aircraft had been landing and taking off every 20 minutes in the daylight hours. The service, which was operated by a small privately-owned English company, was a great example of the use which enterprise and imagination could make of the air.

Citing a variety of air cargoes, the Minister said that the mercantile marine of the air was bringing immeasurable benefits to mankind and helping people to know each other better.

King Aircraft Celebration

LAST week-end the King Aircraft Corporation, of Hillington, Glasgow, celebrated its tenth birthday by giving a dinner and dance to all the employees. In addition, some 50 or more technicians from the industry, Ministries and Corporations were present.

Reviewing the work of the past year, Mr. James McEwan King, chairman and managing director, said that with 30 per cent fewer employees an output equal to the peak production of the war had been reached.

The company is at the moment engaged on machining a large number of vacuum valves for atomic plant, but the main work is the production of the well-known King toggle cowling-fastener. In addition to the standard fastener, with a tensile failing-load of 7,000 lb and weighing only six to eight ounces according to size, there is now a junior model with a failing-load of 2,000 lb and weighing only two and a half ounces. A new flush-fitting panel which requires no tools and can be opened with the gloved hand is under development and appears very promising.

King cowling-fasteners, incidentally, are specified for the Hawker P.1067 and are already in use on such diverse types as the Percival Prince and Provost, Westland Wyvern, A.W. Meteor N.F.11, Auster Ambulance/Freighter, and the Short S.A./4.

HERE AND THERE

FOR FRENCH RESEARCH: The second prototype of the Arsenal VG-90 naval jet fighter, seen here, will be used for research flying, including the air-testing of Arsenal ramjets, to be mounted at the wing-tips. The first VG-90 was lost last year when a main undercarriage leg came unlatched in a high-speed turn, broke off and carried away the tailplane. Like the first machine, the second is also powered with an Hispano-Suiza Nene of 5,000 lb thrust.

Avro Canada Appointments

FOLLOWING the resignation, owing to ill-health, of Mr. Walter Deisher, Mr. Crawford Gordon is to become president and general manager of A. V. Roe (Canada) Ltd. Mr. Gordon has been in charge of armament production for the Canadian Government. Sir Roy Dobson becomes chairman of the Avro Canada Board.

Korea's Yuletide Mail

CHRISTMAS letters and cards sent by surface mail to H.M. ships in the Korean war zone, says the Admiralty, should be posted by October 24th. The final day to ensure parcel deliveries was yesterday, October 18th.

By Helicopter to Guernsey . . .

POSSIBLY the longest sea flight to be attempted by helicopter was successfully completed last week when F/L. D. C. L. Kearns, with Lieut. D. T. J. Stanley, R.N. as navigator, flew a Royal Navy Westland-Sikorsky helicopter from Gosport to Guernsey—a distance of 115 miles. The helicopter, which was escorted, returned to Gosport the same afternoon.

. . . but Not to Sark

IT HAD been intended that the helicopter should fly the further eight miles from Guernsey to Sark, but as no previous notice had been given of the intention, the deputy Seigneur, daughter of La Dame de Sark, refused permission because of the fear that the arrival might have stampeded the cows tethered on parts of the island. Livestock, particularly the feathered variety, do not take at all kindly to helicopters, and it has been suggested that the beat of the blades overhead may be instinctively associated with the wing-beat of a large bird of prey.

Telling America

PRODUCED by the British Information Services in New York and printed in England, a booklet entitled "British Aircraft" is being given wide circulation throughout America. Primarily it is a collection of photographs—and very excellent ones—of current machines, but there is an altogether admirable introduction by Mr. Christopher Clarkson, the civil air attaché at the British Embassy in Washington.

Abadan Aftermath

SOME 60 per cent of all high-octane petrol produced outside America came from Abadan. The loss of this supply is affecting, or is expected to do so for a while, several air services. India in particular is concerned, and B.O.A.C. has cancelled two freighter services to Singapore and some charter services in India. Australia has only three weeks' supply of 100-octane fuel. Companies are reluctant to create new refining capacity for high-octane fuel because of the increasing use of turbojets and consequent reduction in high-octane fuel consumption.

Fokker Transport Plans

IT IS learned on good authority that Fokker Aircraft intend to re-enter the field of commercial aviation as soon as possible, and a new twin-turboprop airliner has been mentioned as the probable design. It will be recalled that immediately after the war Fokkers announced that they were designing a two-Nene transport and that a model was subsequently shown at the Paris show.

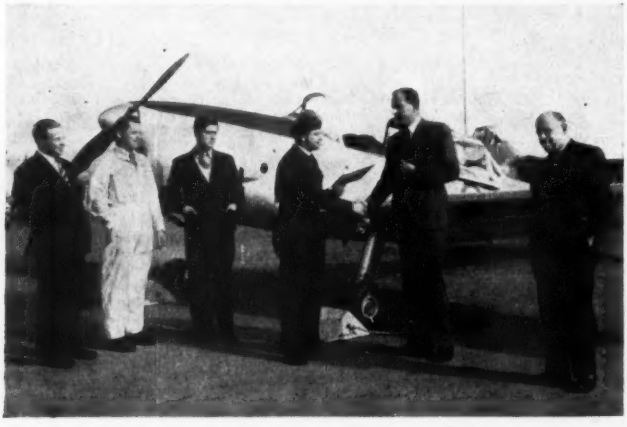
U.S. Interest in the Valiant

ACCORDING to *Aviation Week*, a new U.S.A.F. competition for a medium jet bomber may be a means of getting the Vickers Valiant into U.S. production. The type has already been highly praised by U.S. military officials and Vickers-Armstrongs are reported to be carrying on "an active sales campaign" within the U.S.A.F. Another possibility suggested by our American contemporary is the use of a modified version on the U.S. Navy's super carrier (see page 503), since the Valiant is believed to have a much lower landing speed than its principal competitor, the Boeing B-47. A special Valiant/B-47 pictorial feature appears on pages 510 and 511 of this issue.

Helping Hatfield

THE 1,000th aircraft to be produced at the de Havilland factory at Chester—a Chipmunk—left there on October 9th (see accompanying photograph) for delivery to one of the Reserve Schools. Since it went into production in the early summer of 1948 this important "outstation" of the Enterprise has averaged more than one aircraft for each working day, contributing several different military and civil types to the home and export markets. Incidentally, it is stated that export and licence business from the English factories of the D.H. aircraft, engine and airscrew companies, together with the Airspeed division, has amounted to a value of £30 million since the war ended, while overseas orders totalling £15 million are on the books.

CHESTER'S 1,000th: As related on this page, a Chipmunk was the 1,000th aircraft to leave the de Havilland Chester factory. Seen here with the aircraft are (left to right) Mr. D. B. Taylor, test pilot; Mr. F. Fifield, test pilot; Mr. J. Hanslip, chief test pilot; F/Lt. T. Wier, who holds the Polish Cross of Valour and the Polish Air Force Medal; Mr. J. C. Corby, general manager of the Chester factory; and Mr. J. Mackenzie, production manager.

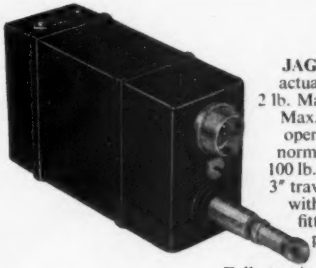


EVERY BRITISH AIRCRAFT RELIES ON PLESSEY

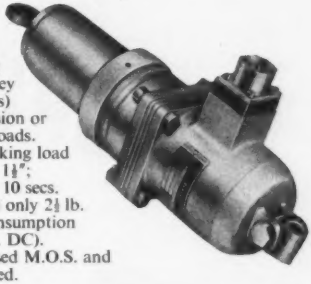
Plessey

electric ACTUATORS

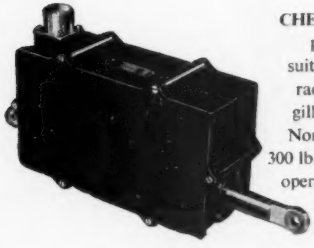
Aircraft designers and manufacturers who have problems involving the remote control of any inaccessible equipment are invited to write to Plessey for literature giving technical specifications of the wide range of electric actuators available.



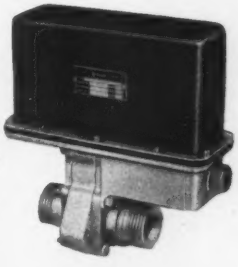
JAGUAR Linear actuator weighing 2 lb. Max. stroke 3″; Max. load 150 lb.; operating time at normal loading of 100 lb. is 7 secs. for 3″ travel. Available with various end fittings to suit particular installations. Fully tropicalised M.O.S. and A.R.B. approved.



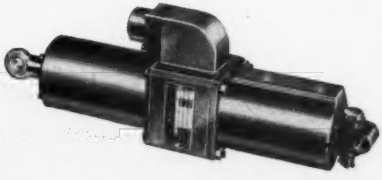
COUGAR This inline unit is (like all Plessey linear actuators) capable of tension or compression loads. Maximum working load 400 lb.; stroke 1½″; operating time 10 secs. Total weight is only 2½ lb. and current consumption 2.9 amp. (24 v. DC). Fully tropicalised M.O.S. and A.R.B. approved.



CHEETAH A more powerful actuator suitable for operating radial engine cooling gills, etc. Weighs 4 lb. Normal working load 300 lb.; max. stroke 3½″; operating time 13 secs. Current 2.25 amp. Fully tropicalised.



LYNX This fuel cock unit incorporates the Vickers-Armstrongs A1792 Mark H "P" type reciprocating action cock. Operating time 1.8 secs; total weight 3½ lb.; current 1.1 amp. (24 v DC). Fully tropicalised.



CUB PUMA A compact inline actuator for tension or compression loads. Maximum working load is 250 lb.; stroke 1″; operating time 9 secs. Weight 2½ lb. Current consumption 1.75 Amps. Fully tropicalised. M.O.S. and A.R.B. approved.

The Plessey range also includes rotary actuators, for the operation of fuel cocks and other equipment up to a maximum load of 600 lbs. ins.

Plessey

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NIMONIC ALLOYS

The brilliant performance of Britain's military aircraft is one outcome of the metallurgical skill that produced the Nimonic Series of Alloys. These nickel-chromium alloys have proved repeatedly, both on test and in service, their ability to withstand the severe stresses at extreme temperatures encountered in the gas turbine.

Every British aircraft gas turbine in production makes use of one or other of the Nimonic Alloys for rotor blades.

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HERE AND THERE . . .

New-world Protection

THE General Electric Company announced in New York last week that "the largest radar system ever" has been installed by the U.S.A.F. to guard the United States and Canada against air attack.

Thunderjet Flying Restricted

BECAUSE Allison J-35 turbojets, as installed in the Republic F-84 Thunderjet, are being conserved for Korean operations, flying hours on Thunderjets are being severely restricted in Germany, England, France, Denmark, Belgium, Holland and Norway.

Russian Jet Target Tug

THE Soviet twin-jet bomber, sometimes known by the probably incorrect designation Tu-10, is employed in Germany as a tug for 10-ft sleeve targets. It is likely that a heavy fighter version exists, in addition to the bomber and trainer variants already illustrated in *Flight*.

Private Archives

A DIRECTOR of Tubular Construction Systems, Ltd., Mr. William E. Appleby, owns what is believed to be the world's largest private collection of aircraft press-cuttings and photographs, entitled "Encyclopaedia of the World's Aircraft". According to an article in the *Bristol Review*, Mr. Appleby's files are overflowing from the room originally reserved for them into an an airing cupboard, a dressing-room and "sundry other accommodation". At the moment he is trying to get permission to build a suitable extension to his house.

Master and Grand Master

THOUGH, in fact, it was no more than a happy coincidence, it was particularly appropriate that Captain O. P. Jones, should head the crew of the Stratocruiser in which H.R.H. The Princess Elizabeth flew to Canada, for Captain Jones is a founder-member and past Deputy Master of the Guild of Air Pilots and Air Navigators, of which the Princess is, of course, Grand Master. Readers may have noticed also that the Stratocruiser *Canopus* carried the registration G-AKGK (call sign "George King").

MIG MAULERS: The inscription "Gunsight and radar access" on the panel above the gun ports of this U.S.A.F. Sabre, gives a clue to the mounting successes of Sabres against Mig-15s in Korea. The pilot on the left is Col. Benjamin S. Preston, group commander of the 4th Fighter Intercepter Group. He is congratulating 1st Lt. James E. Heckman, who, like himself, is credited with one Mig destroyed and one damaged. The Sabre's armament is six 0·5in guns.

France's Ejection Seats

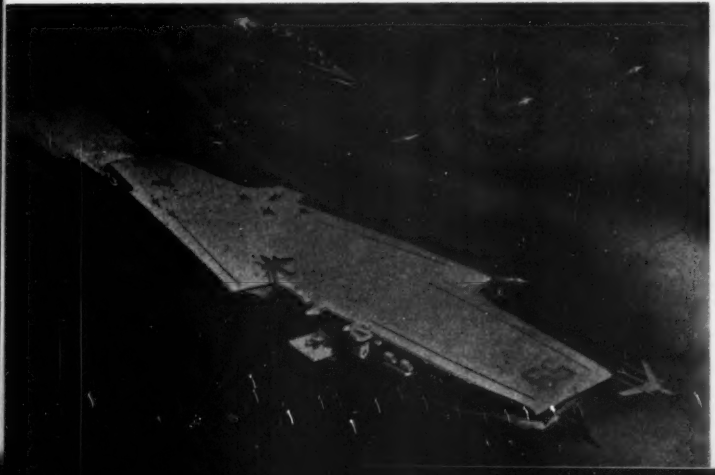
A FIRST series of 500 ejection seats for installation in French-built Mistral (Vampire development) and Ouragan fighters has just been received by the S.N.C.A.S.O. works.

"Hot End" Production

A NEW factory, opened recently by the Solar Aircraft Company, will be devoted entirely to the manufacture of steel pressings for turbojets. Solar Aircraft, who are one of the leading producers of such items in U.S.A., will use techniques that employ the "maximum number of automatic machines and assembly line methods" in an attempt to place these components in the mass-production category. The first job of the new factory will be to produce J-47 parts for the Packard Motor Car Co., for which approximately 50 resistance-welding machines and 45 presses have been installed.

"But madam, I can assure you, you ARE facing the engines."

SUPER CARRIER: An impression of the U.S.S. "Forrestal," the 59,900-ton aircraft carrier which is due to be launched three years hence. The "Forrestal" will be the first American carrier to incorporate a flush flight deck—made possible by a retractable bridge. She will be 1,040ft long and will have a beam of 128ft at the waterline. There will be four catapults and four lifts, and the designed speed is over 30 knots. Unusually large aircraft will be carried.



IN BRIEF

THE fleet of 60 new general-purpose airport refueling trucks mentioned on page 489 last week have been ordered, and will be operated by, The Shell Petroleum Co. Ltd., and not by B.O.A.C. as stated.

* * *

Claiming Europe's largest output of oil seals, Super Oil Seals and Gaskets, Ltd., of Birmingham, recently opened a new factory near Cardiff. The company also makes high-pressure flexible tubing and mechanical mouldings.

* * *

Four new filters for aircraft hydraulic systems each capable of handling operating pressures of up to 3,000 lb/sq in have been developed in the U.S.A. by Purcolater Products, Inc. These units can accommodate 0.5, 3, 6 and 12 gall/min respectively.

* * *

D. Napier and Son, Ltd., of The Vale, Acton, W.3, announce that Mr. J. B. Waite has been appointed Sales Manager (Aero Engines). Mr. Waite has had considerable experience in the British aircraft industry. Before he joined the Napier company in 1942 he had been with Armstrong Siddeley Motors, Ltd., and Hawker Aircraft, Ltd.

ARTIFICIAL SATELLITES EXPLAINED

The Space-station Project: What It Is and How It Might Work

By V. A. FIRSOFF, M.A.

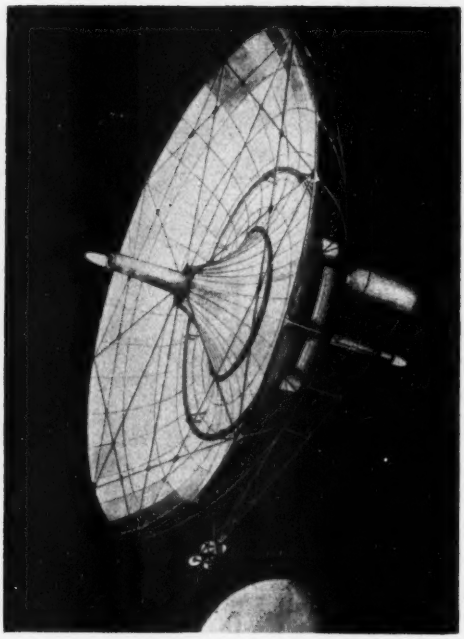
THE recent Astronautics Conference in London focused new interest on the subject of earth-satellite vehicles, space-stations and their possibilities. Inevitably, however, the discussions were of an esoteric nature: the sponsors of the various schemes, many of them distinguished men of science, tended to talk a technical language of the kind that frightens away the man in the street—or even in the orthodox aircraft-design office. To all who have felt a curiosity on the subject we commend this reasoned explanation by an astronomer.

AIRLESS space is often spoken of as though it were just nothing—a void. Yet this is a mistaken point of view. Space is full of gravitational and other fields of force, and these are no less tangible than solid matter which, after all, is not so solid—in fact, the more we know about it the less solid it appears. We can hang an axe on a gravitational field and it will stay put just as though it were hanging down on a hook from a rafter. All we need do is project the axe into a closed orbit. And if an axe, why not a vehicle, a building, or a fully equipped scientific base?

The idea of a permanent base outside the atmosphere but anchored in the earth's gravitational field is not new. It dates back to Kurd Lasswitz's novel *Auf Zwei Planeten*, published in the "remote antiquity" of 1890, and was elaborated by Count von Pirquet, Potocnik, Oberth and others in the inter-war period.

The Transylvanian mathematician, Herman Oberth, one of the great lights of modern rocketry, was responsible for the conception

German A.9/A.10 compound rocket, which was expected to have a range of 3,100 miles. The larger unit, the A.10, is the booster which starts the A.9 on its journey.



How the space-station conceived by H. E. Ross and R. A. Smith might appear. The 200 ft reflector would collect solar energy for the station's own requirements.

of the so-called "sun-gun," with which the Nazis were toying at an "Official level" during the closing stages of the recent unpleasantness. Though they did no more than toy with it, the idea is sufficiently startling to warrant a digression here.

The sun-gun was to be an enormous concave mirror of sodium foil, stretched on wire netting and anchored in a gravitational orbit in connection with a manned space-station. The area of the mirror would have been some 30 square miles, which seems fantastic until we reflect that objects orbiting the earth are in a condition of free fall; they have yielded to gravitation to the full extent, and can yield no further—that is to say, they have no weight. Nor is there any weather, with the possible exception of magnetic storms.

A coiled netting of thin wire would suffice, and unwinding could be achieved by rotation. Properly attired weightless workers would then swarm up this wire cobweb and spread upon it the glittering foil.

Sodium is a light, silvery metal and is soft, like putty. In the presence of air or water it cannot exist in the pure state, but in the vacuum of space it would remain untarnished. Sodium foil could be manufactured on the spot by the simple process of rolling the plastic metal.

The sun-rays focused by such a mirror of appropriate curvature "could influence local climate, could create or prevent storms, melt icebergs" and, in case of war, "burn cities, explode ammunition plant," and generally wreak havoc. From what we know about our late enemies, it is not too much to suspect that the melting of icebergs was *not* uppermost in their minds. However, their nearest approach to a space-station was the compound A.9/A.10 rocket, which was expected to have a range of 3,100 miles (5,000 km), and thus, when fired from Germany, to be able to reach the American seaboard. The project was in the experimental stage, but things did not go too well with the A.9, which was to be fired automatically from the larger A.10 booster rocket as soon as the latter's fuel was spent.

It was even planned to make the A.9 a man-carrying rocket, not unlike the adaptation of the A.4 ("V-2") suggested by the British designers, Messrs. H. E. Ross and R. A. Smith, which, however, has been cold-shouldered by the Ministry of Supply.

Although Germany lost the war, some of the work still goes on—even, in some cases, carried on by the same men under a changed "management." In 1945, the Americans seized all the materials they could get hold of in connection with this research,

and set up the highly secret "Project Rand," entrusted to the Douglas Aircraft Company; various tasks were distributed among the Service departments, and special research establishments created for this purpose. In the 1948 report to the Senate, the Defence Secretary, J. V. Forrestal, made it public that Project Rand aimed at nothing more nor less than an earth-satellite vehicle, i.e., a space-station. It is expected to be placed 36,000 miles short of the moon, where it would revolve round the earth in the same period as the "natural satellite," and thus keep constant position between the two heavenly bodies.

How far the matter has advanced we do not know, but last year Messrs. K. W. Gatland, A. E. Dixon and A. M. Kunesch, of the British Interplanetary Society, produced the blueprint of a compound three-step rocket with expendable fuel tanks, which would be capable of entering a closed gravitational orbit outside the atmosphere. [Since this article was written several such projects were discussed, at the recent Astronautics Congress.—Ed.] The project is merely tentative and intended to show that this is a practicable venture. It makes recourse only to the published data on the A.4 and its derivations, such as the U.S. Naval Viking, and the authors, who are experienced in aircraft design, add that this stage has already been left behind in our rocket research. This is a heartening indication that things have not been in abeyance in Britain. What is happening behind the Iron Curtain is pure conjecture, but it is a safe guess that the Russians have not been asleep there either; in fact, the Red Fleet newspaper recently described a Russian-designed rocket powered with 20 jet engines (sic) for flying to the moon. A somewhat obscure hurdle-race with the first space-station as the prize is now seemingly in progress.

It may be said that this is all very well, but how is it to be achieved, and what is its purpose? As a first step to answering the first query, let us pick up a stone and hurl it into the air with a gesture of defiance.

Throwing the stone accelerates it to a certain velocity, with which it is released and is left to proceed against gravity. This soon decelerates the stone to zero velocity at the peak of its trajectory, and then bends the trajectory down to the ground. Had there been no ground and no air resistance, the stone would have gone on falling, missed the centre of the earth by some yards, and come back to the hand that threw it with its original velocity. Uncaught, the stone would have gone through the same antics once more. As things are, however, its journey is interrupted and it gets no chance of completing its elliptical path.

A high-altitude rocket behaves in exactly the same way. It accelerates up to a certain "all-burnt" velocity (a function of the exhaust velocity and the ratio of the initial fuelled weight of the missile to its final-stage structural weight) and then continues to ascend by inertia until this velocity has been eaten up by gravity. At this point the rocket turns back, to describe its interrupted orbit. Yet this orbit need not be interrupted; its descending arm may miss the ground and the atmosphere as well. If this happens, the rocket will go on flying round and round the earth—an independent satellite body which, barring gravitational perturbations, will continue on its prescribed course for eternity.

To gain a working insight into this orbital technique, we need consider two components of the rocket's velocity: the vertical, which at first will determine the ceiling of the trajectory, and the horizontal, which will determine its width or minor axis.

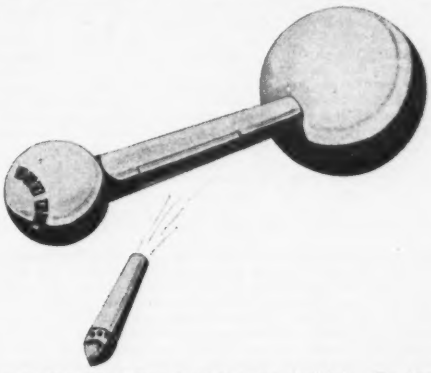
Let us now take up a position at the equator, select, for example, 2.56 miles second as our vertical component (which will project the rocket to 620 miles, just outside the exosphere) and start increasing the horizontal component. Even if we give our rocket no horizontal velocity, it will still have the velocity of the earth's spin, which here amounts to 1,520ft/sec. The ellipse will be narrow, and the rocket will hit the ground on the return; but as the horizontal component increases the projectile will be hitting the ground farther and farther away until it strikes the antipodal point, then passes it and eventually misses the earth altogether. The lowest point of its orbit is now in the air, and the rocket may fly right round the globe, though it will be slowed up by air resistance and brought down sooner or later. Further increase in the horizontal component, however, will raise the lowest point, and when this component becomes 4.53 miles/second, the "lowest point" will draw level with the ceiling: the rocket will then be revolving round the earth in a circular orbit as an earth satellite.

Had our ceiling been 22,300 miles, on reaching the circular velocity (different for each altitude), we would have witnessed a peculiar spectacle: our rocket would have remained motionless in the sky. For in this particular circular orbit the period of revolution is 24 hours, so that the rocket would remain stationary with regard to the ground. This is the kind of space-station fancied by the Austrian Captain Potocnik and, indeed, a 24-hour artificial satellite has much to commend it.

However, a rocket projected into a closed orbit outside the atmosphere is not at once a space-station; it is at best but the nucleus of one. Our first attempt will probably be an unmanned orbital rocket carrying recording instruments which radio their data to a receiving station on the ground. In fact, in the three-step British project already referred to, the final payload is only 110 lb—just enough for this purpose. Yet with time the "know-how" will have progressed sufficiently for a manned satellite vehicle to be projected into a closed orbit. The delicacy of this operation lies not so much in the increased payload as in the necessity to provide for the return. In other words, the rocket must carry sufficient unused propellant to be able to decelerate back to the atmosphere, where the awkward problem of landing has not yet been satisfactorily solved.

The easiest way to meet this requirement will be by sending several rockets in parallel paths, only one of which need be manned, while the others will be tender-rockets carrying reserve fuel, monitored from the ground and/or the manned rocket. Once orbited, the rockets will be moving in the same direction at the same speed, and thus will be stationary with regard to one another. More, they will be in the condition of free fall (the "hanging axe" referred to before), so that bringing the whole outfit together along the equi-potential gravitational surface will require very little energy, and the task of refuelling the manned rocket-ship will be much easier than the refuelling in air.

This is also the way in which the actual space-station will be built. It would be impossible to have it ready-made on the ground and despatched into an orbit, but it can be prefabricated and sent up piecemeal, to be assembled bit by bit by the crew of the nucleus ship. The hulls of the spent rockets will be too precious to be left encumbering the space around the nascent space-station, besides being a danger to navigation, and will have to be absorbed into its construction—the procedure known as "cannibilization." All this material will be weightless, so that any temporary accumulation of scrap will not present any serious inconvenience.



A contrasting space-station conception—the dumb-bell. The larger sphere would contain fuel tanks, etc., and the smaller would house living-quarters. The connecting-tube might form a hangar for a communications rocket-ship.

Of course, a good deal of exhaust gas will have to pass through the venturis of the experimental rocket-motors before the scheme matures to a practical undertaking. Yet no basically new problems are involved and this is but a matter of technical refinement.

Here we may consider the objectives, and therefore the appearance of an actual space-station built to attain them. Not all of these objectives may be combined in one and the same establishment, but to start with there will probably be just one universal space-station.

The possible uses of a space-station are indeed manifold. We have already referred to the sun-gun. Professor Oberth also envisaged the possibility of using plane space-mirrors to provide reflected sunlight after dark to large urban areas as a cheap substitute for the old-fashioned street lighting. The idea, like that of the sun-gun, has certain difficulties, but it indicates one of the practical and peaceful uses to which a space-station could be turned. The U.S. earth satellite vehicle is frankly a military project, which is always easier to finance than a purely scientific scheme. It would appear to be intended for global observation and as a launching site or controlling station for guided missiles against terrestrial targets—which, however, does not exclude its use for research. The military uses of space-stations are a sad prospect to those who have fostered astronautics in the hope of bringing mankind together. On the other hand, what is sauce for the goose is sauce for the gander, and an atomic rocket would in no time make a frightful mess of an enemy space-station, sun-gun and all. Means of offence and defence grow side by side.

It would, of course, be a disaster if so splendid a technical achievement of man were to be thus wantonly destroyed, and

ARTIFICIAL SATELLITES EXPLAINED . . . .

space-stations can have many constructive uses. Indeed, there is a strong case for making them an international venture instead of instruments of national power.

Global observation need not be warlike in purpose; if extended to weather, it would greatly facilitate local forecasting. A space-station could, too, greatly expedite the task of iceberg-reporting. It would be invaluable to the astronomer whose work is greatly hampered by the instability and partial non-transparence of the air. The study of some physical and biological phenomena, such as, for instance, high-frequency gravitational oscillations, or influence of cosmic rays on mutation, is made very difficult by the earth's gravitation and atmospheric shield. Finally, television broadcasting is now severely handicapped by the curvature of the earth and a relaying station in space would greatly simplify matters. Mr. A. C. Clarke maintains that the broadcasting facilities provided by a space-station would alone be worth many times the outlay, which was estimated by Count von Pirquet, perhaps over-optimistically, at barely £2,000,000 at pre-war cost. All this apart, we must not forget that a space-station would be a stepping-stone to the outer space. It would serve as a depot where inter-planetary space-ships would be serviced, revictualled and refuelled without needing to descend to the bottom of the earth's gravitational whirlpool, and ferry rockets would bring the necessary materials and relieve the crews at such intervals as might be found advisable.

Let us, therefore, have a look at a modern space-station as designed by Messrs. H. E. Ross and R. A. Smith. Here we have our old acquaintance the sun mirror, now referred to as the "bowl." Shaped as a parabolic semi-torus of 200ft diameter, it would be used not for terrestrial purposes but to collect solar energy for the station's own requirements by concentrating the rays of the sun on a system of pipes. These conduct boiling fluid (water or mercury) to eight turbo-generators spaced round the "bun" which nestles in the hollow reverse of the bowl. The designers calculate that 3,900 kilowatts of solar energy could be trapped by a mirror of this size and shape, and some 1,000 kilowatts should be available for actual use.

The bun houses machinery, workshops, store-rooms, laboratories and living quarters. Behind it is a lattice "arm," whose main object is to serve as a radio aerial, but it is linked up with a "no-gravity chamber" and an airlock entrance, at which the visiting space-ships dock. The whole structure is pivoted on a long "pipe" (this part of its anatomy is of my own christening), round which the pipe, the bowl and the bun rotate. The arm is not normally in rotation but, if desired, can be synchronized with the bun. The pipe consists of two strobotelescopes looking in opposite directions. (A strobotelescope is a stationary telescope equipped with one or more coelostat mirrors which are moved by clockwork in such a way as to cancel out the rotation of the structure and thus provide static vision.)

The rotation of the station has a twofold purpose; it gives it permanent orientation in space and creates a centrifugal force in the living quarters which acts as a substitute for gravity, the total absence of which for long periods would probably be physiologically and psychologically harmful.

The living quarters consist in this design of two galleries lying at different distances from the axis of revolution, so that the "gravitational acceleration" will differ in them. A period of revolution of seven seconds will make it 0.43g (the terrestrial value) in the inner, and 1g in the outer gallery, which the designers regard as satisfactory. The attitudinal control of the station is assured by a "box" of six electrically powered gyros at the hub of the structure. This will be necessary, if only to keep the mirror facing the sun during the annual movement of the earth in her orbit.

Space does not allow me to enter into other technical details of this project. Of course, a space-station may be built on a different plan. For instance, a dumb-bell structure is widely favoured. Our experience of conditions obtaining in space may render some of the precautions unnecessary, wh le unexpected difficulties may arise. Very little indeed is known about the physiological requirements of space flight. On the whole, however, this should give us a fair idea of what a real space-station will look like.

I would not venture a prediction how long it will take to clothe these thoughts with duralumin and sodium foil. This seems, however, to be a matter of decades and not centuries, while unexpectedly rapid developments may radically alter the picture.

ROTOR BLADE DE-ICING

THE use of helicopters in both military and civil spheres has, up to the present, been successful inasmuch that the effects of ice formation on the rotor blades has not seriously affected their performance. It has been realized for some time, however, that successful all-weather operation of rotary-wing aircraft cannot be expected without a suitable ice-prevention system. American experiments towards the end of the late war, in fact, indicated that the accumulation of ice on the blades could, under unfavourable conditions, be serious; but due to problems of higher priority, the development of a practical de-icing system was not achieved.

Tests have recently been conducted, however, by Sikorsky Aircraft, with the object of developing a de-icing system, which, if the need arose, could quickly be installed on the S-51, or any of its variants. For various reasons (one of which was the difficulty of adequate theoretical treatment of alternative schemes) it was decided to take advantage of the inherent rotor blade construction and incorporate a heated-air system. The leading edge of the rotor blade (which is also the blade spar) consists of a single-piece aluminium alloy extrusion, having no chordwise ribs. A continuous duct from the root to the tip is thereby provided, which was found to be ideally suited for the thermal de-icing system envisaged since no structural alterations were needed.

The modification required to adapt the standard production blades was simple, consisting only of the insertion of an insulated entry at the root and the provision of a suitable tip exit. The insulated rotary collector at the rotor hub was supplied with heated air by means of ducting from an independent combustion heater. This heater—attached externally to the port fuselage, forward of the rotor column—was chosen in preference to a heat-exchange unit utilizing the engine exhaust gases because of its greater flexibility for test purposes and its relative simplicity. It was estimated that approximately 125,000 B.Th.U./hr, with an airflow of 1,700 lb/hr, would be required. The equipment chosen was capable of 200,000 B.Th.U./hr and 2,000 lb/hr of air and it was possible, by means of automatic and manual controls, to vary the heat flow from 90,000 to 180,000 B.Th.U./hr.

Although flight tests under controlled icing conditions have yet to be made, it was found that there was good agreement between predicted dry-air performance and flight-test results. Concurrent studies of alternative methods were not made, mainly because of the ease with which the standard equipment could be modified for almost immediate use.

FORTHCOMING EVENTS

Oct. 21-28. Aero Club of Algeria: Tour of Algeria.
Oct. 24. R.Ae.C.: Jubilee Ball, Londonderry House, Park Lane.
Oct. 24. Royal Air Force College, Cranwell: Rugby v. Oxford University Greyhounds (away).
Oct. 25. R.Ae.S. Graduates and Students Lecture: "The A.B.C. of Stability," by K. S. Lawson.
Oct. 30. Society of Instrument Technology: "Materials for Instrument Manufacture," by E. B. Moss.
Oct. 30 R.Ae.S.: "Supersonic Propellers," by Dr. W. F. Hilton, A.F.R.Ae.S. (Section lecture in the library of R.Ae.S).
Oct. 31. Royal Air Force College, Cranwell: Boxing v. Oxford University (away).
Nov. 3. Royal Air Force College, Cranwell: Fencing v. Cambridge University (home).
Nov. 6. R.Ae.S. Graduates and Students Lecture: "Design Costing," by Mr. Bunnett.
Nov. 14. Royal Air Force College, Cranwell: Rugby v. R.A.F. XV (home).
Nov. 23. Helicopter Association: "The Giant Helicopter," by O. L. L. Fitzwilliams, B.A.
Nov. 24. Society of Licensed Aircraft Engineers: Main Lecture: "Functioning of a Manufacturer's Servicing School," by D. W. Richardson, M.B.E., A.F.R.Ae.S.
Nov. 24. Royal Air Force College, Cranwell: Rugby and Squash v. R.N.C. Greenwich (away); Soccer and Rifle Shooting v. R.M.A. Sandhurst (away); Old Cranwellians Dinner (London).
Nov. 27. Society of Instrument Technology: "Visual Presentation," by K. F. H. Murrell, M.A., F.R.P.S.
Dec. 1. Pathfinder Club Annual Ball, Dorchester Hotel, London.
Dec. 1. Royal Air Force College, Cranwell: Boxing v. R.M.A. Sandhurst (home).
Dec. 5. Royal Air Force College, Cranwell: Rugby and Squash v. R.M.A. Sandhurst (home).
Dec. 5. Royal United Service Institution: "The War in Korea, with Special Reference to the Difficulties of Using our Air Power," by W/C. P. G. Wykeham-Barnes, D.S.O., O.B.E., D.F.C., A.F.C.
Dec. 21. Institute of Navigation: "Meteorology and Navigation," by Lt. Cdr. P. G. Satow, D.S.C., R.N.
Jan. 18. Helicopter Association: "A Review of Helicopter Patents," by L. H. Hayward.

H" & "C" *or* The Vapours *or*, simply, Tank Losses

ON one flank of my favourite tobacco tin, in very small letters, runs the legend "Sold subject to loss in weight by evaporation." Similar inscriptions on the labels of bottles remind me to replace the cork or cap. Well, I'm not grumbling: I pay for my tobacco and liquids with money that is notoriously subject to loss by inflation. Fair's fair.

Come to think of it, nearly everything and everybody these days is subject to loss by evaporation, inflation or volatility—call it what you will.

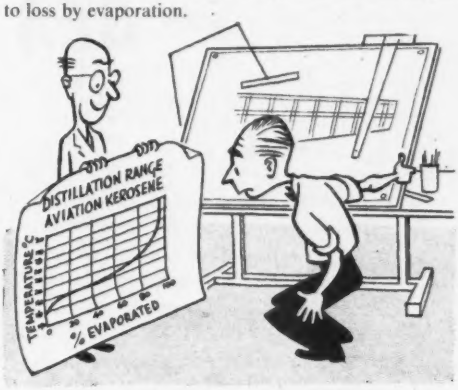
Even aircraft fuels.

Let me explain. Turbine fuels, as used in modern gas turbine-engined aircraft, are very similar chemically to ordinary domestic paraffin: you know—the stuff that looks something like this to the naked eye of a research chemist:

No, sir, this is *not* a diagram showing the arrangement of taps (faucets?) in a Hollywood bathroom: it's a picture of a droplet of paraffin, its skeleton or molecular structure.

Turbine fuels then—whether they're the unidentical twin of domestic paraffin or some mixture of kerosene, heavy petrol and light diesel oil—all contain a fair proportion of relatively volatile hydrocarbons. Now when fuel is carried in a modern jet aircraft it will evolve vapour on attaining height and these vapours tend to escape into the atmosphere via the tank vents of the aircraft.

In other words the volatile hydrocarbons are subject to loss by evaporation.



Fortunately this loss can be minimized, *is* minimized by the researchers who inhabit the "Esso" laboratories. And they keep on minimizing it.* It's all a matter of how they arrange the "H's" and "C's" and etceteras, or so I'm given to understand.

There's another thing. All hydrocarbon fuels contain dissolved air, which is released when the liquid is warmed or depressurized (to coin a barbarous term!). Sometimes this release is violent, so violent that even liquid fuel is carried away with the escaping air. More losses.

Fuel manufacturers appreciate this—the process is fundamental to the behaviour of all petroleum fuels—and they can help the aircraft manufacturers by providing data on the behaviour of fuels over a range of temperatures and pressures. And this is precisely what "Esso" scientists *do* do.* They work hand in glove with the men who design and build Britain's aircraft.

* Two more reasons, surely, why

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Elizabethan This is our name for the BEA version of the Airspeed Ambassador — the latest British civil aeroplane to come into airline service. It is being introduced this Autumn first on the London/Paris route and later on others. Elizabethans have two 2,600 h.p. engines, accommodate 47 passengers in a pressurised cabin and cruise at 245 m.p.h.

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Pionair The most modern version of the famous DC-3 in service anywhere in the world, the Pionair is used on most of our services within Britain. It accommodates up to 32 passengers, has engines giving a total of 2,400 h.p. for take-off and cruises at 167 m.p.h. Pionairs are named after famous British Aviation pioneers.

Clansman The BEA version of the H.P. Marathon. A short-stage aeroplane for some routes within Britain—mostly in Scotland. Though small, the Clansman is as comfortable as many larger aircraft. Its four engines develop a total of 1,380 h.p., it cruises at 171 m.p.h. and accommodates 20 passengers.

Islander Our name for the D.H. Dragon Rapide. We use it on the Penzance-Scilly service, and on short-stage services around Scotland and in the Channel Islands. Islanders can accommodate eight passengers, cruise at 117 m.p.h. and have two engines developing 406 h.p.

BEA

BRITISH EUROPEAN AIRWAYS

PERFORMANCE INDEX

Assessment of an Italian Suggestion for a New Unit of Power for Turbojets

We have received from Italy a proposal suggesting a new method of stating the performance of turbojets. This proposal we submitted to Power Jets (Research and Development) Ltd., for assessment. Below are given the original suggestion and the criticism.

PROPOSAL

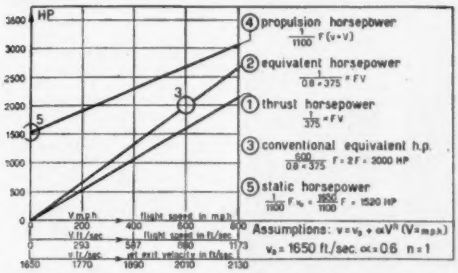
THE Director-General of Italian Civil Aviation and Air Traffic recently submitted to the British and U.S. Aeronautic Registers (*sic*) a proposal for the international adoption of a conventional unit of power for turbojets. The unit would be expressed in horsepower on the simple formula $\frac{1}{1100} F.V_e$, in which F is maximum static thrust, lb, and V_e is exhaust gas velocity, ft/sec, relative to a fixed point.

The new performance unit would be designated "static power" or "basic power" and the following advantages are claimed on its behalf:—

(i) It is independent of flying speed.
(ii) It represents the true power of the engine as actually developed from a fixed point.
(iii) Its range of variations is more limited than that of alternative units of power at present in use, in that it states the initial power produced $\left[\frac{1}{1100} F (v+V)\right]$
(iv) It is derived from values that are easy to measure in test chambers, i.e. static thrust and mass flow, the exhaust velocity being a function of those quantities $\left(Fv=\frac{F^2}{M}\right)$

The "static power" would thus present itself—as in other engines—as one of the basic data of a design and would form, therefore, a positive foundation for calculating the three fundamental indices, size, weight and consumption, which are the common standards of comparison among engines on land, sea and in the air. The present drawback of having to link consumption, weight or size with one of the values that make up the power available for flight is thus obviated. The proposer of this suggested new unit of performance holds the opinion that the present criterion of relating the output of a turbojet with the power available for flight is also unsatisfactory because the F.V value covers only one aspect of the engine and thus interprets the output imperfectly. The suggested new unit of power does at least contain the first two of the fundamental data of turbojet performance (thrust, flow and flight speed), and should therefore allow the quality of the engine to be judged fairly well.

As things are today, the evaluation of even the equivalent power is arbitrary, in that the coefficient by which the thrust is multiplied $\left(\frac{1}{0.8}\right)$ expresses neither the conditions of an airscrew nor those of a propulsive jet. In fact, in the range of speeds at which aircraft operate today, it is impossible to attain so high a propulsive output whilst, on the other hand, a theoretical airscrew would not retain so high an efficiency at these speeds.



Different powers of a turbojet of 1,000 lb static thrust = F.

To the objection that the output of a turbojet is linked with the speed of flight, it has to be observed that a satisfactory value of the "static power" represents the best guarantee that the power unit would have a good output in non-static conditions.

It should be noted that new engines are publicised with two values on which the manufacturers are particularly insistent, viz., maximum output and specific consumption. Such data are secured (for turbojets as well as for engines of other types) during the static tests: it would thus seem to be legitimate to express these values in the same units that are in general use, i.e. static horsepower and lb/h.p./hr. These two values, together with the power/weight ratio and the power/frontal area ratio, would be useful as a basis of comparison, whilst the turbojet values of static thrust and specific fuel consumption (lb/hr/lb) could retain their present practical meaning.

The accompanying graph shows the position of the suggested new unit of power among the various values that could be taken into account. It may be seen from the graph that the maximum static power of a turbojet unit of 1,000 lb static thrust has a value lying between those of thrust developed when flying at 500 m.p.h. and the corresponding equivalent power.

It is understood that the proposal suggesting the adoption of the new unit described will be discussed at one of the forthcoming international aeronautical congresses.

CRITICISM

THIS is a perfectly reasonable proposal which, although it has not been commonly used is, however, by no means new. The unit proposed

$$\frac{\text{static thrust (lb)} \times \text{jet velocity (ft/sec)}}{1100}$$

is the kinetic energy of the exhaust gases, expressed in horsepower—that is, the shaft power which would be developed by a 100 per cent efficient turbine placed in the exhaust stream and absorbing all its available energy. In order to measure the effect on the aircraft this power has to be multiplied by the propulsive (Froude) efficiency which, for a jet engine, is :

$$\frac{2 \times \text{aircraft velocity}}{\text{aircraft velocity} + \text{jet velocity relative to aircraft}}$$

This is, of course, zero when the aircraft is stationary and increases continuously as flying speed increases. The actual value of propulsive efficiency at a given speed depends on the detail design of the engine (its thermodynamic cycle, component efficiencies, etc.). At forward speed the measure of the power of the engine should not be simply "jet kinetic energy (h.p.)" but "jet K.E. minus K.E. of intake air (h.p.)" —that is, velocity energy added to the air in its passage through the engine.

These figures have been used for a long while on the Power Jets instructional course, both when considering the thermodynamics of jet engines and also in the test analysis. They do provide a most useful means of assessing the performance of an engine in relation to other prime movers which the normal thrust and specific consumption figures do not do. On the other hand, in order to get an idea of the *effective* power of a turbojet, one would have to carry in one's head figures for propulsive efficiency at various speeds, and this is not so easy as it is with an airscrew where one well knows that in the designed speed range the efficiency is likely to be about 80 per cent.

The real answer seems to be that neither thrust nor jet

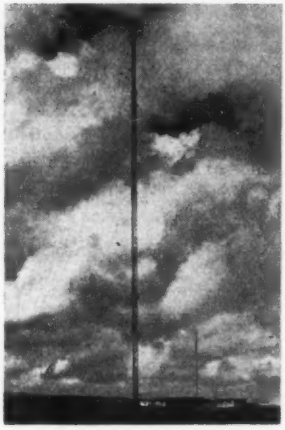
PERFORMANCE INDEX . . .

h.p. figures give a true picture of the power of an engine unless related to a particular speed. There seems to be no good way of overcoming this difficulty, simply because of the large (and differing) variation of propulsive efficiency with speed peculiar to jet engines.

While it is agreed that the suggested parameter is probably somewhat better than thrust on some grounds—for example, where one is interested in the engine as such rather than as a propulsive unit—it is undeniably worse on others. In addition, since it is not a quantity that can be measured directly on a single instrument, jet-horsepower is not likely to commend itself widely to the practical test and development engineer. Perhaps the best purpose would be served by keeping the term as a useful tool for the design man.

ADDITIONAL HAZARDS

THE second high-powered television transmitter to be completed under the B.B.C.'s post-war expansion programme was officially opened and put into service on Friday, October 12th, by Lord Simon of Wythenshawe, chairman of the B.B.C. Designed and erected by British Insulated Callender's Construction Co., Ltd., it is situated at Holme Moss, nine miles south-west of Huddersfield. We draw attention to this inauguration as one more among the increasing number of obstructions and restricted areas which may be seen dotted around the countryside.



Designed to withstand wind velocities of up to 125 m.p.h. this new television transmitter aerial stands 2,500ft above sea level.

A very large number of people will be able to enjoy television relayed from the Holme Moss mast; nevertheless, it is a potential danger to aircraft — the top being shrouded in mist and cloud for about half of the year. In this connection it will be noted in the "Air Pilot," under the heading of Air Navigational Obstructions, that the items which cause the most concern (from the height-above-sea-level viewpoint) are, in fact, the three B.B.C. television transmitters, one of which is not complete. They are situated at Sutton Coldfield, Holme Moss and Kirk of Shotts (Lanarkshire), and their heights above sea level are 1,320ft, 2,500ft, and 1,660ft respectively.

HAMILTON TURBO STARTER

THE Hamilton Standard Division of United Aircraft Corp. have just announced their development of a new type of starter for gas turbines, which is stated now to have passed its pre-production tests and to have gone into limited production. The starter is operated by compressed air either from a ground source, or from another gas turbine. The air is passed through a turbine wheel which is connected, through a gear train, to a clutch. When operating at full power, the turbine—which peaks at approximately 45,000 r.p.m.—delivers over 100 h.p. for spinning up the gas turbine's rotating assembly. The start is stated to be accomplished in approximately 20 seconds.

ON CARBURATION

Carburation (Vol. 1, 3rd Edition, Revised), by Charles H. Fisher, M.I.Mech.E., M.S.A.E. Chapman and Hall, 37, Essex Street, London W.C.2 Price 36s.

SINCE its first publication in 1939 under the title *Carburation and Carburettors*, the scope of this work has steadily been widened, until now, with the appearance of the third edition, it has been necessary to divide the book into two volumes. The first deals mainly with the theoretical aspects of the subject and, apart from the complete revision and extensive amount of extra material brought into each section, the author has added chapters on detonation, the carburation of heavy tractor fuels, and petrol injection in aircraft engines.

Mr. Fisher is a renowned authority on his subject, and this new and enlarged edition of a firmly established work will be welcomed by all who have to deal with carburation in its many aspects.

UNSHACKLING THE PILOT—AN AMERICAN DEVELOPMENT

The Aero Medical Laboratory of the U.S. Air Materiel Command has developed a unified trunk system (right) to contain the pilot's oxygen supply hose, g-suit hose, and radio leads so as to obviate the random "spaghetti" tangle (left) which, with their several separate connectors, previously made ejector seat operation unduly difficult. This design is unquestionably an advance for the American fighter pilot but, by comparison with the latest design of British equipment illustrated in the September 7th issue of "Flight," does not show to particular advantage. Neither of the accompanying pictures, incidentally, gives a completely true impression of the pilot's gear, for the demonstrator is not wearing parachute or seat harness.

THREE ITEMS OF OUTSTANDING INTEREST

at the SBAC Farnborough air display

★ **The SNARLER ROCKET MOTOR**

The next logical step in jet aircraft propulsion—a liquid propellant rocket motor independent of atmospheric oxygen.

★ **The record breaking SAPPHIRE METEOR**

On August 31st a Gloster Meteor fitted with 2 Armstrong Siddeley Sapphire turbojets established 4 new time-to-altitude records.
(Subject to official confirmation)

★ **The SAPPHIRE CANBERRA**

Sapphire turbojets built under licence in America by the Wright Aeronautical Corporation will be fitted to American Canberras.

ARMSTRONG SIDDELEY MOTORS LTD

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Members of the Hawker Siddeley Group.

The AIRSPEED AMBASSADOR

British European Airways

ELIZABETHAN

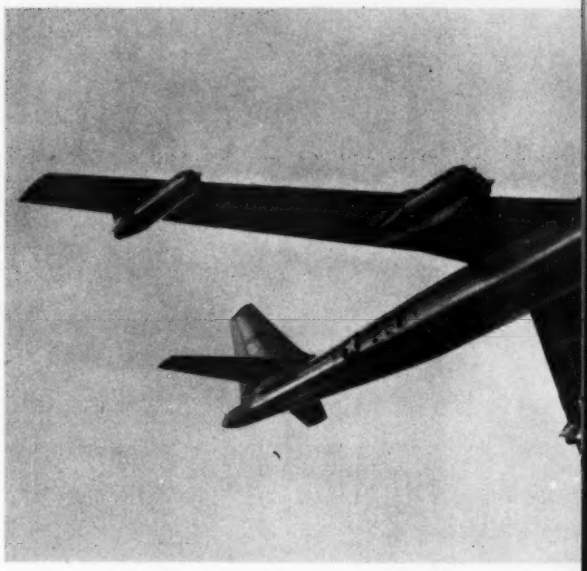
Class Airliner

THE AIRSPEED DIVISION OF THE DE HAVILLAND AIRCRAFT COMPANY LIMITED

SECOND TIME UP

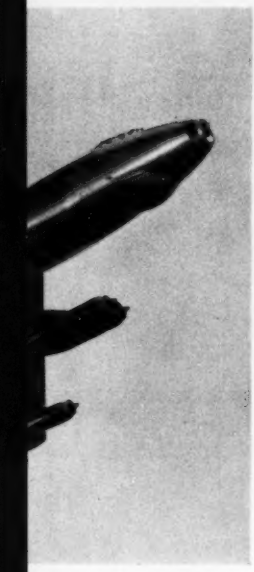
THIS splendid study of the D.H.110 night and all-weather fighter (2 Rolls-Royce Avons) was secured from a Dove while John Cunningham was making the second flight of the new fighter after sunset on September 28th. Little can be said concerning the 110, but it is officially stated that it was designed to meet "the special needs of the R.A.F.", to have "a very high performance" and to carry "modern electronic navigation and combat aids". Points to note are the offset cockpit enclosure (the radar operator's cabin is to starboard), the boundary-layer intake bleeds and "fences", and the turbo-jet installation. Dimensionally the 110 is very much larger than previous D.H. jet fighters (the pilot's head gives scale).

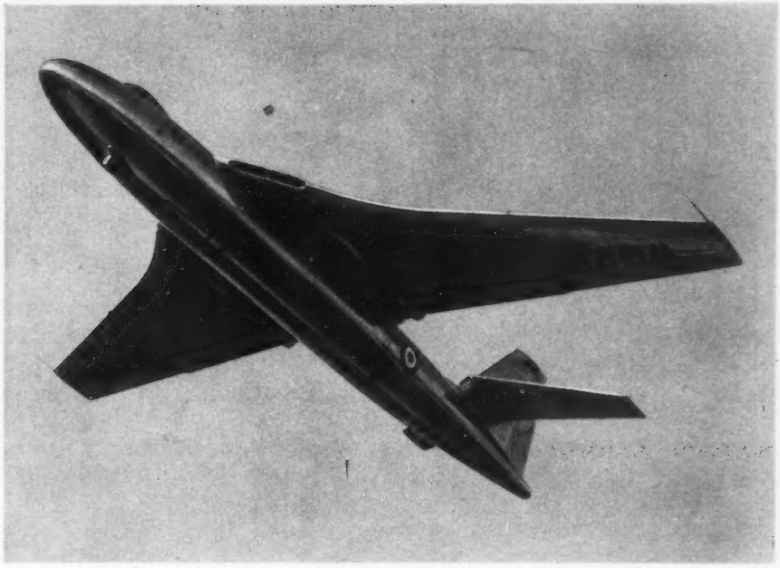
WHEN the 600-m.p.h., six-jet Boeing B-47 bomber (left-hand views), with its high aspect, small-area wing and six "podded" turbojets, appeared in 1947 it was unique in its class. Now, at long last, Britain can show with pride the Vickers-Armstrongs Valiant (right-hand views), seen here to represent a very different approach to the problem of reconciling high performance with long range and load-carrying capacity. With its generous wing area and four "buried" Rolls-Royce Avons, the Valiant should be able to operate at exceptional heights (with advantage to speed and range) and, as demonstrated at the recent S.B.A.C. Display, has take-off and landing characteristics which are hardly compatible with the wing loading ascribed to the Boeing. But whereas the first B-47s are coming into squadron service, we must regret that only a single Valiant exists.



TWO APPROACHE

Graphic Comparisons of the Vickers-Arms
Multi-jet High-speed Bombers, for th





S TO A PROBLEM

rongs Valiant and Boeing B-47 Stratojet
R.A.F. and U.S.A.F. Respectively

The unique and remarkable fortified town known as the City of Carcassonne is a rewarding destination—and a fine landmark—for air tourists. It is some 550 miles south of Lympne and almost equi-distant from the Spanish border, Toulouse (50 miles to the north-west), and the Mediterranean coast.

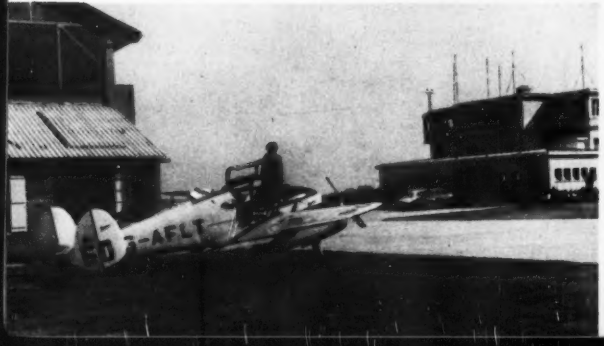
CONTINENTAL RALLIES

—WITH PARTICULAR REFERENCE TO CARCASSONNE

by The Editor

RECREATIONAL flying has virtually come to an end in Britain until next spring, and nearly all the air rallies "at homes" and competitions are over for another season. In recent years, during each summer, a number of invitations have been received—almost invariably through the Royal Aero Club—for British pilots to spend a week-end at this or that resort or town as the guests of either a flying club, an influential individual or, perhaps, the local wine producers. The words "air rally" have come to mean a get-together of people who arrive by air; otherwise there is usually very little to do with flying except for the "shop" talk and the convivial fellowship and common enthusiasm which undoubtedly link flying people of all nationalities together in a unique manner. When left to themselves, pilots of different nationalities are the very first to strike up a friendship.

Frequently the first stop in France, Le Touquet is a lively little airport offering all normal facilities, but in particular a welcome, Customs and steaks at almost any hour. Our Gemini, seen in the foreground, was carrying a partially dismantled B.S.A. motor cycle and required a manifest similar to that used by the Silver City Bristol Freighters, for which the two Rover cars beside the terminal buildings are waiting.



The best-known and largest Continental rally is that organized at Deauville each year through the generous hospitality of those good friends of all British aviators, M. and Mme. André. Every year since the war, large parties of club pilots and private owners, with wives and friends, have descended in ever increasing numbers at St. Gatien airfield on a Friday or Saturday at the beginning of July. Having signed in they say goodbye to their aircraft until the Monday morning, enjoying in the meantime the truly royal hospitality accorded to all M. André's guests. A similar, though rather smaller rally is organized at La Baule—usually on the following week-end and with the same host.

All through the summer months other smaller rallies are organized with the intention of introducing the British pilots to the pleasures and entertainments peculiar to the different areas of France. By comparison with the expense of paying such visits as private individuals, the cost is very little and representative amounts might be £2 to enter for the rally and arrival competition; £1 or £2 organization fee, payable to the R.Ae.C.; £1 per head as the agreed figure to cover all gratuities of the hotels; and the cost of the petrol to fly there and back.

Because of the regulations in force in this country, one must be careful about making arrangements to hire an aircraft and share the flying expenses, but that is one obvious way to keep individual travelling costs down. It should not be forgotten, moreover, that a duty-free refuel is permitted when taking-off for another country. In France, the Customs official simply signs copies of the purchase form on the spot, but in England a refund must be claimed on the appropriate forms. Whichever way it is done a very considerable saving can result. Landing fees are normally waived at the destination airfield, and if one puts down at an *en route* field such as

The PRESTWICK PIONEER powered by the Alvis Leonides engine

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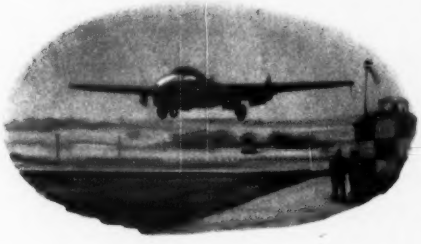
ALVIS LIMITED COVENTRY ENGLAND

For the first experience in jet operations the Vampire Trainer—light, docile, able to use small airfields, and possessed of all the advantages of side-by-side seating—is unsurpassed.



DE HAVILLAND

all-purpose jet

VAMPIRE TRAINER

Three vehicles were involved at the start of the journey. The car carried the passenger and baggage to the Gemini while the motor-bike, left, seen stripped before being stowed in the aircraft, carried the pilot. On the right, the motor-bike is seen in position across the back seats of the Gemini.

CONTINENTAL RALLIES . . .

Gatwick or Lympne, there is no fee if the landing is made solely for Customs clearance.

The most convenient and popular Customs field on the French side is probably Le Touquet. Here a small landing charge is made, but everything is done very efficiently and met. and flying control have been first-class this year. The V.H.F. radio (117.9) is also good, and English can be used for requests and instructions. The airport manager, M. Sainsard, told us recently that a competition is to be organized for visiting pilots, a cup and a sizeable cash prize being awarded to the one who gains most points in a season. The number of visits and the distance flown each time will determine the number of points to be awarded towards the grand total.

The cuisine at Le Touquet is very good under the latest management, but prices are high. At other airfields in France they often talk jokingly about the "poor tourists" and the "bandits at Le Touquet." The convenience of having a good meal with a wide selection of dishes waiting at the airfield at almost all times must, of course, be paid for. Our experience is that a good lunch for two will cost about £3. This is roughly twice what one would normally expect to pay.

Occasionally, rallies entice entrants rather further afield, and particularly memorable, for example, have been those organized by the Spanish Royal Aero Club with the Duke of Almadova del Rio as chief host. The week's air tour of Spain, though strenuous, is most enjoyable.

Recently a small invitation rally was arranged by the Aero Club de l'Aude at Carcassonne, situated in the South of France, not far from the Spanish border. As an end-of-season affair it suited a few people very well, and while the reluctant English sun prepared to depart altogether for the winter, it was very tempting to chase after the autumn warmth still to be found in the South of France.

Like other participants, we decided to link up the rally with a few days' holiday, and set off in a leisurely manner from Fair Oaks with two or three days to spare. Weather permitting, the journey could, in fact, have been made in the day without any great difficulty or hurry. In the event, evening was arriving by the time our Gemini had reached Tours—another pleasant venue for British aircraft on the occasions of air rallies organized by the local Aero Club de Touraine.

Convenient and speedy though air travel can be, there is always the problem of transport at the destination. Taxis are expensive, as are hired cars to visit the countryside. Even the beautiful promenade at La Baule, for example, becomes uncomfortably long after the first few walks up and down. For this reason it was decided to take a small motor-bike capable, without discomfort, of carrying two people and a picnic lunch for forty or fifty miles in a morning. It may be mentioned that the French, of whom very many own a small "moto" or "velo," applauded the idea and were most intrigued to see the smart green 125 c.c. B.S.A. Bantam snugged in the back of the Gemini.

The Flight to Carcassonne

To start from the beginning, it must be recorded that the flight to Carcassonne began on a dull, cloudy and bumpy morning. Willing hands had helped install the Bantam across the back seat of the Gemini. It had been necessary to take off the wheels and mudguards as units, and these carried with them the carrier, pillion seat, number plates and so forth. Because two nuts release the spring forks at the top end, these were removed together with the front wheel. The handlebars were also released and turned along the tank. The silencer slid off easily enough, and the only grubby bit was the removal of the chain.

Sacks, sundry straps and the seat belts padded and held the bike firmly in position, and there was still plenty of room at the back for a small suitcase and a soft zip-top bag in addition to coats and the bike's twin panniers (which on the return trip each held three bottles of wine as well as tools and rags). The rest of the luggage—a large hold-all like a parachute bag and a B.O.A.C. shoulder bag—went in the aircraft's nose compartment.

The method of loading the Bantam—arrived at after experimenting all ways—was to carry it rear-end forward up the wing

An idea of the popularity of the Deauville Rally can be gained from this aerial view of the visiting-aircraft park at St. Gatien aerfield. Following the aerial views of new military and commercial aircraft published after the Farnborough display, this picture provides another more difficult exercise for the spotter who may wish to identify light aircraft—mostly of pre-war design—in current use.

CONTINENTAL RALLIES . . .

walk, then to reverse, forks first, diagonally into the cabin.

It may be of interest to record that the motor-bike required its own carnet and, of course, a G.B. plate, but no international driving licence was needed to ride it in France. A manifest covering the bike was called for at Le Touquet, and on the English side a check was made *in situ* (with the aid of a mirror) on the engine and frame numbers. No one asked whether any petrol was being carried in the tank at any time.

As usual we cleared Customs at Gatwick, and not being as brave as some, filed a V.F.R. flight plan and set off for the short Channel crossing from Dungeness to Boulogne. G-AFLT usually flies as sweetly and smoothly as one could wish, but over water she vibrates (or so it seems)—both engine and airframe—with an intensity in direct proportion to the length of the crossing and the inclemency of the weather. On this occasion the London clag was soon left behind, and by the coast we had clear sunshine and 5,000-odd feet of height. Under these circumstances there is practically no vibration at all! Any that there was vanished as Lympne came through strength 5 in answer to my V.H.F. request to be shepherded across. "Roger Love Tare, call mid-channel," said the Lympne operator, and we knew that we were being checked across.

After the mid-way call Boulogne came into view ahead, and we peeled off towards Le Touquet, diving off height and using speed to offset the strong headwind which we now encountered. As we crossed the French coast between Boulogne and Le Touquet at about 1,800ft, we were still able to contact Lympne at strength 3 and receive 5s.

A handsome plaque presented to the Royal Aero Club guests by the Mayor of Carcassonne. Nearly three inches in diameter, it is inscribed "To the delegation of the Royal Aero Club of Great Britain."

A word has already been said about Le Touquet. We were instructed to use runway one seven, which is approached across the end of one four, and is a rough grass strip to be used with considerable care. We arrived for a late lunch, having coped with Customs, then visited met. and control prior to departure.

The French take their flight planning very seriously, and met. forecasting and communications have improved month by month. A call was put through to Tours, more than 200 miles away, regarding our flight, and instructions and clearance obtained in only two or three minutes.

On resuming the flight south we coast-crawled to Dieppe in fine weather and then turned on to 195 deg M. towards Rouen. Map reading was very easy, and in almost exactly two hours Tours came up ahead. We amused ourselves by making ground speed checks and found that we were covering ground at the rate of 97 miles in the hour. The A.S.I. showed about 125 m.p.h. at 1,500ft, and the Cirrus Minors were turning round at 2,300 r.p.m. This confirmed the forecast headwind of 20/25 kt.

At Tours we received radio instructions about use of runways and the gliding in progress. The airfield is large and under military control. The two concrete runways, damaged and patched, are now undergoing major repairs. First it was necessary to check in on the military side, then we taxied over to the club and arranged for hangarage overnight. A lift to the Hotel Metropole—noted for its grill—was arranged by a club official.

The Aéro-Club de Touraine will shortly have to leave its premises at St. Symphorien to make further way for the French Air Force, and there are plans to take over instead a satellite field not far away.

Next afternoon there was bright sunshine but, we were told, "much instability." Heavy hailstorms swept by and towering cu and cu nim was to be seen here and there. We bounced on south, our track lying conveniently between the storms, until Limoges passed underneath. After this the storms increased, and at one time we feared that we would have to turn back. With

Farewells and thanks are said at Carcassonne airfield. Beside the Gemini is an Auster belonging to Mr. and Mrs. Dykes, and the group comprises hosts with their wives, and guests of the Aero Club de l'Aude.

some of the highest ground on the flight beneath and angry black cloud ahead and above, we had a glimpse of the serpentine gorge of the River Lot before spending some ten minutes on instruments with hail hitting the aircraft with the sound of a roll of drums.

When a turn on to the reciprocal course began to seem the wisest action, a slight clearing was noticed, and within a minute or two bright sunshine pierced the gloom and all was well. The town of Brive had presumably passed by underneath, and quite soon we were able to pick out landmarks among the light railway lines. We noted some remarkable little villages, one with a cluster of ancient buildings, and a church balanced on a rocky ridge dividing a deep river gorge. The name did not appear on our map but the village of Laguépie lay to the south. After that the country opened out and Albi passed by to port.

More storms covered Castres and the Black Mountain area north of Carcassonne, and having sampled one of them we decided to alter course round the back of this one. On rounding the higher ground we were glad of the decision, for thick cloud trailed right in among the trees on the hill sides. The wind had now veered around to the west and aided us on our last few miles.

Ahead lay Carcassonne in bright evening sunshine, the towers of the city standing out against the matt brown and green country-side. We circled once, then returned to the grass airfield and landed. Club members present helped unload and assemble the "moto," and in half an hour or so the Gemini was hangared and a car was taking luggage and leading the bike to the Hotel de la Cité.

During our stay as guests of the Aero Club de l'Aude we were shown much of the rich store of ancient buildings and of mountain scenery within easy drive of Carcassonne, and we were also conducted over the remarkable Cité itself.

Vice-president of the Aero Club is M. Bourelly, a distinguished architect and authority on the ancient buildings. He made the visit of the Aero Club delegation, as it was called, the more interesting by his explanations of the styles and periods of the buildings and fortifications. In fact, the Cité can show a few scraps from Roman days—parts of the cathedral and a mosaic beneath the castle—although much more is the work of the Visigoths who came over the Pyrenees early in the fifth century. The greatest part of the existing fortifications were built in the thirteenth century. For example, between 1255 and 1260 the outer *enceinte* was added. For the exceptional state of preservation and skilful restorations seen today, thanks are due to Viollet-le-Duc who commenced his work in 1844.

For the rally guests the days were all too short to see all that Carcassonne can offer. Nearby we were surprised to see (from the air) a gold mine, which is producing several pounds of the metal each day. All round the grape harvest was being gathered into the "co-operative caves." When M. Dudognan, the Aero Club's president, could not be with us, M. Bourelly and M. Lasserre, Dr. Gout, M. Busque—all club members—were always ready with their help, hospitality, and—very important—cars.

The Mayor of Carcassonne, M. Itard-Longueville, presented the rally visitors with a handsome plaque from the Cité, and his speech at the official dinner paid a warm tribute to the work of the R.A.F. toward the liberation of France. A brief official civic reception was held, and a second was arranged by the prefecture.

In the evenings of Saturday and Sunday, S/L. Turnbull, Messenger, and the author pushed out their aircraft and gave club members and their families rides and demonstrations. Everyone was keen to fly, and their enthusiasm both before and after, not to mention their well-informed comments upon such matters as the speed range of the two aircraft, augur well for the future of private flying in France. In passing, it may be added that to further the interest in aviation, selected participants in air rallies might be invited to volunteer to fly past or give rides. Occasionally this could be a good thing.

When the time came to leave and our thanks were said, we hoped that our Carcassonne Aero Club hosts would visit us in England. To this the replies were most polite but it was made clear that they could see very little reason to visit a country which had such weather and put up with such a lamentable cusiine.

The flight home was made for interest sake via Toulouse and Deauville. It was pleasant and uneventful, as air touring should be.

"ASSESS" BEGINS

Coastal Command Exercise Covers 400,000 Square Miles and Lasts Nine Days

THREATS to the security of Britain, with its 50 million inhabitants, can come from either the air or the sea. In the first event it is Fighter Command that bears the responsibility; in the latter case Coastal Command and the Royal Navy share the burden. Although devoid of the glamour attaching to fighter combat, the work of Coastal Command is equally essential, for if our anti-submarine forces lose their battle, then the other Commands are quickly robbed of the means to protect Britain or to mount an offensive. It is, therefore, to test all we have learnt since the war, and to try out a considerable amount of new equipment, that the exercise, code-named "Assess," is being held. The first period was from midnight October 9th to October 14th; the second, from October 18th to October 21st.

At a conference at Coastal Command H.Q., the A.O.C.-in-C., Air Marshal A. C. Stevens, marked the opening of the exercise by reviewing the equipment available and the various phases which were to be "fought" over a period of nine days and over an area exceeding 400,000 miles. The battle, he said, would go on continuously, day and night, and bad weather would not stop operations. True to form (although there was quiet anti-cyclonic autumn weather over the greater part of Britain) a deep depression near Iceland coincided with the start of the exercise and brought gales over much of the Atlantic area.

For the purpose of the exercise, vessels of the Royal Navy have been divided into "Blue" and "Red" forces, the latter representing a Continental power which has declared unrestricted war against shipping and is strong in submarines but relatively weak in surface vessels.

A "Blue" convoy passing along the north and west coasts of Scotland provided the opening target for "Red" submarines and carrier-borne aircraft. To an Avro Shackleton went the honour of locating the first submarine—at 0656 hr, about half-way between Rockall and the Scottish coast. Using practice bombs to simulate depth charges, the Shackleton attacked and subsequently signalled a "kill" to base. Two other submarines—one directly in the path of the convoy—were later sighted. As the first convoy rounded the north of Scotland a second was approaching the British Isles from the North Atlantic. Again submarines were active, and one Lancaster reported two sightings within 45 min. Very little "enemy" fighter activity was reported, but one Sunderland in the Clyde area signalled that it was being attacked.

During the first 24 hours of the exercise no fewer than seven submarines were located and attacked. Some of the Coastal Command bases were affected by fog, and rain and gales persisted over the western part of the operational area. Up to 6 p.m. on the second day of the first phase no further sightings of submarines had been reported, neither was any air opposition experienced by patrolling aircraft.

Aircraft of No. 12 Group, Fighter Command, are assisting Coastal Command in its defence. Late phases will include the defence of coastal convoys moving up the Channel. Some 40 ships of the Home Fleet, including two carriers, a cruiser and a number of destroyers, frigates and submarines, are taking part. These vessels are steaming darkened by night, but star shells and other pyrotechnics will be fired against attacking aircraft. The Naval forces are commanded by Admiral Sir Philip L. Vian, C.-in-C. Home Fleet.

In common with other R.A.F. Commands, "Coastal" has suffered a drastic reduction in strength since the war, but is now expanding and re-equipping. The Shackletons are already putting up some remarkable performances: one has flown an average of over 17 hr a day for ten consecutive days and another has put in 22 hr 20 min flying in a single day. Four have averaged over 520 flying hours each in three months, one aircraft completing 228 hours in 14 non-consecutive flying days during the final month.

In the operations room at Coastal Command headquarters. The A.O.C.-in-C., Air Marshal A. C. Stevens, A.V-M. G. E. Nicholetts (Senior Air Staff Officer) and F/L. L. I. Coulstock.

During the next month or two the first of the P2V-5 Neptunes ordered from Lockheed should arrive and air-crews are already in America preparing to take delivery. In service the Neptune will be complementary to, and will not replace, either the Shackleton or the Sunderland. Despite the fact that the type holds the world's long-distance record, it will be used in the R.A.F. for relatively short-range coastal convoy protection. This is because the fuselage has insufficient room to carry the large aircrew and paraphernalia necessary for long-distance Atlantic patrols. The Neptune can, of course, carry a variety of weapons and is readily adaptable as a strike aircraft for use against surface shipping.

Air Marshal Stevens also announced the intention of forming a flight of Bristol 171 (Sycamore) helicopters for the study of rotary-wing aircraft in the anti-submarine and air/sea rescue rôles. Delivery of the first Sycamore is promised for next month.

The position of the flying-boat is still undecided. No replacement for the excellent Sunderland has yet been decided upon, but there is under consideration a turboprop boat of twice the Sunderland's displacement.

FREIGHTERS FOR CANADA

THE Bristol Aeroplane Co., Ltd., announces the sale to the Royal Canadian Air Force of a quantity of Type 170 Freighters, the first of which will leave Filton later this month on its delivery flight. The sale is a direct result of the company's policy of expansion in Canada: its Canadian subsidiary, the Bristol Aeroplane Company of Canada, Ltd., now wholly owns British Aeroplane Engines, Ltd., of Vancouver, and the Canadian Light Montreal engine repair base. Bristol Freighters are now in service in all Commonwealth countries.

The Canadian Freighters are of the latest type (Mk 31), with Hercules 734 engines rated at 2,000 h.p. for take-off. The struts of the nose doors have been repositioned to give an extra 3ft 6in in length at the front of the cargo hold, and the aperture in the rear bulkhead has been increased to 6ft x 6ft. Greater fuel capacity (1,170 Imp. gall) has increased the range to 1,650 miles. The delivery flights are being undertaken by Silver City Airways.

MODERN AIRWORTHINESS

R.Ae.S. Lecture by the Chief Technical Officer of the Air Registration Board

IN presenting his paper, *Modern Trends in Civil Airworthiness Requirements*, given before the Royal Aeronautical Society yesterday (October 18th), Mr. Walter Tye, O.B.E., F.R.Ae.S., told his audience that much of the lecture was unashamedly speculative. That the speculations were based on a very firm grasp of a complex matter the lecturer, perhaps naturally, did not see fit to add. But Mr. Tye has the most intimate knowledge of his subject, and his speculations could not well avoid being taken as pointers to the way developments might best progress. The lecture was divided into three sections: safety in general, airworthiness, and crashworthiness, and a digest of the subject-matter is given hereunder.

Mr. Tye started his lecture with a reference to yardsticks for measuring safety, and commented on the popular datum of fatalities per 100 million passenger miles, saying that it had so dramatic a ring that it seemed almost to be an honour to be the single fatality. A technically better concept was accidents per million aircraft miles, and to give realism to the scale, a million aircraft miles were flown in a week in England, and in a day in America. Such yardsticks provided an idea of what was happening, but gave no clue to the degree of safety the passenger really wanted. Mr. Tye suggested that no one wanted 100 per cent safety : to take all precautions against death would make life so horrible that death would be a happy release. The risk one was willing to accept on a particular occasion depended largely on two factors—the advantage gained by taking the risk and the believed measure of control over the circumstances. We used private cars, climbed mountains, or indulged in private flying knowing the average risk was fairly high, but were content to take it. In air transport the advantage gained was a saving of time, but the passenger abandoned all personal control : the sense of comfort of being able to get out and walk was missing, and this led the passenger to want more safety than he otherwise would. A second point was that the public assessed risks from what it read in the newspapers, and unfortunately an aircraft crash often killed enough people to be headline news. The private car could quietly and effectively kill people without incurring the same sense of catastrophe.

On the subject of accident causes, the lecturer stated that for the U.S. airlines the major accident figures were that one in four was caused by a lack of airworthiness, and two by pilot error. The British accidents showed a much smaller percentage for lack of airworthiness, this being probably due to the fact that certain classes of American accident, such as fire in the air, loss of airscrews and structural failure in flight, had been mercifully absent from British operation. It was also partly due to the fact that accidents from operational causes were much less frequent in America, so that airworthiness assumed more prominence.

Mr. Tye next questioned whether so-called pilot error was wholly attributable to human failure. About one quarter of the fatal accidents in American air transport during recent years were caused by stalling, and of these, one half had occurred on one particular type of aircraft which was believed to have bad stall characteristics. It would seem, therefore, that the provision of good stalling characteristics was one way of minimizing pilot error accidents.

Accident reports offered little direct proof that complexity of control and instruments resulted in pilot errors. Yet it was felt that the simpler these were, the better was the pilot able to concentrate on avoiding dangerous circumstances. The pilot was frequently judged, probably unfairly, to be at fault in respect both of navigation and of making instrument approaches. It was significant that, in over one-third of the British accidents examined, the aircraft struck the ground in bad visibility. The solution appeared to be the provision of approach and navigational aids which presented information accurately and reliably, and in a much simpler form. Radio aids would possibly achieve this eventually; certainly, the incentive to do so was high. The lecturer's interpretation of accident causes led him to believe that, in British operation, an attack on pure airworthiness would show small returns, but large rewards would result from lightening the pilot's task, notably in the field of navigation and approach aids and, possibly, by overall simplification of his tasks.

Under the heading "Trends in Design," Mr. Tye next referred to the 50-100 per cent increase in stalling speed compared with pre-war times and the frightful complication of modern aircraft. The form of modern airworthiness requirements was largely dictated by the need to find the footpath on one side of which was the precipice of danger, and on the other side, the slippery slope of drastic economic penalty. The whole trend of requirements was toward a closer matching to the actual design and operation circumstances prevailing in each case.

Typical of this trend were the advances, since about 1935, in structural requirements. The aim had been to couch the requirements in terms of the flight and ground conditions which occurred, instead of the earlier, more arbitrary, average load systems. Generally, this had led to elimination of unnecessary strength margins, but in most cases rationalization had gone as far as it could without more data.

An example of the way in which operational circumstances were being taken into account was found in modern performance requirements. Broadly, the scheme was as follows :

(a) The average performance figures were found for the type of aircraft.
(b) These averages were reduced by a margin to allow for variability of the aircraft, so giving an effective guaranteed minimum.
(c) These guaranteed values were scheduled for a range of several parameters, e.g. temperature, altitude, runway gradient, etc.
(d) From a knowledge of a particular route, and the particular temperature, etc., prevailing, plus the performance of the aircraft, the operator then adjusted the weight so that certain minimum margins were met.

It was clear that once performance considerations were taken into account in fixing the weight, the potential consequences to payload were so profound that one could not stop half-way. Full credit had to be given for any alleviating circumstances, and this modern requirements attempted to do.

The lecturer then indicated how this guaranteed performance was calculated. Operationally identical aircraft flown in operationally identical conditions could produce widely varying performances, and the method used in modern performance requirements was, in effect, to assess the fall in performance corresponding to one in 100,000 occasions. The effect of engine failure fitted neatly into this scheme, and from an assessment of probability averages, it could be shown that most of the extra power-plant weight carried around was to cope with engine failure rather than aircraft variance.

Extended Flight Trials

Referring to extended flight trials, the speaker observed that faith had been lost in the ability of conventional tests to pick out all the possible ways in which a modern aircraft could go wrong. There was, therefore, emphasis on extending the period of flying before certification. This extended flying subjected the aircraft to the practical test of use in typical operating conditions as regards routes, crews and maintenance. Accidents caused by lack of airworthiness were often associated with a detail which had gone wrong in an unforeseen way. Avoidance of such accidents would, therefore, in future depend not only on foresight and attention to detail but, most important of all, on the rigour of the tests to which the aircraft was subjected.

The remainder of the lecture was devoted to crashworthiness, and Mr. Tye justified his emphasis on this subject by stating that only a small proportion of accidents was due to lack of airworthiness. Even if improvements in airworthiness were possible, therefore, the overall accident picture would not be much improved. On the other hand, if an aircraft could be made safer in the crash, lives might be saved in nearly all accidents, whatever their cause.

Mr. Tye then gave an analysis of 66 major British and American accidents divided into classes, and showing the corresponding fatalities. From a crashworthiness viewpoint there was most to be gained by studying the land impact cases as these formed the bulk of the accidents. These cases were further divided into (i) fully fatal, where everyone was killed; (ii) partly fatal, where some but not all were killed, and (iii) non-fatal, where everyone survived.

In the partly fatal accidents the proportion of persons killed varied from 1 per cent to 99 per cent. It followed that for every 100 people involved in fatal accidents about 70 were killed, half in fully fatal and half in partly fatal accidents. Mr. Tye then submitted that, since some survived in partly fatal accidents, by suitable design provisions it should be possible to save more. If all were saved in the present partly fatal cases one person in two at present killed would be saved.

If impact speed was high (cruising speed or above) the proportion of fatalities was high—80 per cent or so—and when speed was low, approach speed or less, the fatality ratio was small, 36 per cent. Fortunately there was only one case in about six in which speed was high. These same accidents, divided according to outbreak of fire, not unexpectedly raised the fatality ratio from about 25 per cent to about 60 per cent.

Since impact speed and outbreak of fire were related factors, the sample could be split into four groups. High speed—with and without fire, and low speed—with and without fire. The fatality ratios were much as one would expect. It was clear that to reduce fatalities two courses were open: (i) to reduce impact; and (ii) to minimize the consequences of impact—both direct mutilation and outbreak of fire. On the first of these courses, one could not legitimately suggest reducing cruising speed, which was fundamental to the usefulness of the aircraft, but approach speeds, take-off speeds, etc., which depended on stalling speed, could be reduced. In a typical sample examined, half the low speed accidents happened to aircraft with stalling speeds of about 90 m.p.h. or more. The fatality ratio for course (i) was twice that of course (ii). It could be that, if nothing was done to prevent it, future fleets would have high stalling speeds and high cruising speeds resulting in an increase of 30 per cent in fatalities. On the other hand, if stalling speeds were kept low, say to 70 or 75 m.p.h., we should gain 20 per cent or so. These rough estimates did not allow for the fact that certain accidents might not occur at all with low stalling speeds, so in fact the difference might be more pronounced. While there was a strong case for further efforts to reduce stalling speeds, one recognized the difficulties, so it would be as well to look next at the internal design of aircraft.

In typical land impact crashes, the energy of the aircraft was absorbed by sliding friction, or by crushing the nose of the fuselage, or both. In level crashes, involving sliding, deceleration of anything between 1 g and 10 g occurred. In more severe crashes in which the fuselage was destroyed, the deceleration probably lay between 5 g and 20 g. In such crashes the rear fuselage often remained intact.

Although offering no direct evidence, it could be shown that if an aircraft, flying initially at its approach speed, came to rest under a uniform deceleration of 20 g, the distance-to-stop was not large. The energy was usually absorbed by crushing the front 30 per cent of the fuselage, so it followed that this approach-speed crash just about corresponded to crushing the whole nose with an acceleration of 20 g. Alternatively, if the aircraft slid a distance equal to its own length, the acceleration would be only 6 g.

Protecting the Passenger

The lecturer then asked, could the human frame emerge unhurt from such deceleration forces? The answer was most certainly yes, if properly supported. With normal safety belts, injuries to the head as it struck objects lying ahead when the body jack-knifed were predominant. In straight fore-and-aft crashes this jack-knifing action rarely caused abdominal injuries, at least up to loads equivalent to 15 g to 20 g. Nor was fracture of the spine at all likely. With sideways sliding forces there was a greater risk of the latter injury.

With shoulder harness or backward facing seats, there was no doubt that much higher accelerations could be withstood, say 40 g, but the simple belt was often a safe answer up to 20 g except for head injuries. The vulnerability of the head was indicated by the fact that, if it struck a hard unyielding object at 16ft/sec, the skull was likely to fracture. With good design of the object struck, higher speeds—between 50 and 100ft/sec—might be withstood. In a 20 g crash it was likely that the head would strike objects ahead at about 60ft/sec, so it was at least in the realm of possibility to minimize head impact dangers by suitable design.

As to the aircraft itself, the fact that the rear fuselage often remained intact pointed to the obvious conclusion that as many persons as possible should sit aft, and that galleys, wardrobes, etc., should be housed forward. It would be wise to take maximum advantage of the inherent safety of the rear fuselage by providing 20 g seats and belts in that region, while allowing 10 g seats and belts forward as higher strengths were of no benefit in the forward position. The objection to this was that it admitted a kind of First and Third Class safety. But the plain fact was that this safety differential existed in any vehicle with a nose sticking out in front, so we could either turn a Nelsonian eye to the fact, or take advantage of any opportunity the basic design offered. Mr. Tye thought the weight penalty for every 10 g seat (compared with current 6 g seats) was about 5 lb, and for every 20 g seat about 15 lb. In a typical case this meant a loss of payload of 6 to 7 per cent.

To protect the passenger from head damage we could provide (a) rearward facing seats, (b) widely spaced forward facing seats, or (c) alternate rows of forward and rearward facing seats—Pullman Car fashion. On safety grounds alone the rearward facing seat was certainly best. With widely spaced forward-facing seats there was a residual risk of the head hitting the cabin wall or window sills. With Pullman seats, at least half the passengers had the advantage of facing backwards. The backward facing seat was also better when there was a lateral component of force.

So far as space considerations were concerned, the conventional 40in pitch of forward-facing seats was an ideal arrangement for dealing a blow to the head. If a considerable rake of the seat-back was wanted, a pitch of 45in or 50in was necessary. With rearward-facing seats the pitch could be much smaller. With Pullman seats 45in pitch was sufficient for the head of the forward-facing occupant to miss the bony knees of the person facing him.

The objection usually raised to rearward-facing seats was that passengers did not like them. The lecturer gave it as his opinion that this was pure nonsense, but it was fruitless to debate a question of fact when the facts were unknown. Such little evidence as there was pointed to the opposite conclusion, and Mr. Tye contended that the objectors to rearward-facing seats had no grounds on which to base their conclusions. What was, however, so appalling was that we had still to make a full-scale operational assessment to establish the truth.

The three alternatives the lecturer had put forward aimed at preventing collision of the head with objects in front. There was reason to hope that suitable design and padding could at least reduce head damage and, while we were faced with large numbers of aircraft with closely spaced forward-facing seats, we should exploit the palliative to the full. The object was to provide a plastic yielding, and to spread the area of contact. Thin-walled large-diameter tubular structure was preferable to small diameter tube in the seat backs. The Americans had demonstrated that material of the plastic "foam" variety was a very satisfactory padding, while rubber, with its rebound properties, was not satisfactory.

Cabin Design

It was very difficult to estimate the potential saving in life consequent on good cabin design. The full advantages could only be attained if fire was avoided. If it was not, we might save some from mutilation only to burn them. Mr. Tye had made a number of estimates which showed that (i) leaving cabin arrangement unaltered, but eliminating fire, should save 33 per cent of the lives at present lost; (ii) leaving the fire risk unaltered, but improving cabin arrangement in the ways outlined, gave a saving of life on a pessimistic estimate of 12 per cent, and on an optimistic estimate 39 per cent; (iii) improving cabin arrangement and eliminating fire gave a saving between a pessimistic 43 per cent and an optimistic 71 per cent.

Even with existing fire risks, the saving in life from good cabin design was well worthwhile. The average of the two estimates, about 25 per cent, corresponded to about a 20 per cent saving of life in all types of crashes. This would be at the expense of about 6½ per cent payload, but was about ten times more favourable a rate of exchange of safety and payload than in the previous example given, i.e., of improved structural airworthiness.

It had long been the hope that fuel would be developed having less vicious properties than petrol, and it was popularly supposed that paraffin would provide an answer. Unfortunately analysis of accidents to military aircraft did not offer any reason to hope that the risk of outbreak of crash fires would be reduced by paraffin-using turbine-engined aircraft by comparison with petrol-using reciprocating-engined aircraft.

Reverting to general design, the lecturer thought that it was clear that major fires could only occur if large quantities of fuel were freed. When no fuel was spilled or if pipelines only were broken, the percentage of fires in major crashes was small, while if the tanks burst the proportion of fires was very large. As was to be expected, the risk of tanks bursting depended on the extent of the damage to the aircraft as a whole. With serious damage, tanks burst on 70 per cent of occasions; with medium or light damage, tanks burst on only 18 per cent of occasions. The interesting point was that with severe damage, which meant wings breaking off, or the fuselage nose completely crushed, on 30 per cent of occasions the tanks survived. If on 30 per cent of occasions, why not more? The lecturer seriously questioned whether the modern bag tank, in the interests of saving weight, was as good as it could be in a crash.

With improved design of integral tanks, and care in positioning them, it seemed likely that they could be as safe as present bag tanks. However, if bag tanks were improved, the speaker doubted the ability of the integral tank to hold its own.

So far as position of tanks was concerned, there was only one really safe place for tanks, and that was in the outboard positions of the wing. This unfortunately offered very little room. It had been suggested that wing-tip tanks (i.e., the military drop tank) might be used with advantage. Mr. Tye did not think the aerodynamic and structural difficulties were serious, and there were two points in favour. The tanks could literally be dropped before a premeditated crash and, in an unforeseen crash, they might be torn away safely, or at least be as remote as possible from the occupants.

LESSONS from an ACCIDENT

Findings of the Court Investigation into the Loss of Viking G-AHPN

SOME important recommendations concerning the safety of civil aircraft when landing in conditions of poor visibility are contained in the report of the Court Investigation on the accident to B.E.A. Viking G-AHPN, which occurred at London Airport on October 31, 1950. Twenty-eight of the thirty occupants lost their lives.

The investigation was conducted by Sir Walter Monckton, K.C., with G/C. S. W. R. Hughes, O.B.E., A.F.C., and Capt. N. S. Head, D.F.C., acting as assessors.

The aircraft in question, G-AHPN, was engaged on a regular scheduled flight from Paris to London under the command of an experienced pilot, Capt. S. D. Clayton. Until very near the end of the journey there was nothing abnormal in the flight. The pilot was informed before leaving Le Bourget that there was a risk of only 400 metres visibility in the London area at 2000 hr, whereupon he prudently decided to take on an extra 55 gallons of fuel. When the machine was 13 minutes out from Gravesend, the pilot was informed by the Uxbridge Controller that the visibility in fog at Northolt was 50 yd. Capt. Clayton then asked for a clearance to London Airport and London Approach Control took over the aircraft immediately. The forward visibility at London Airport was 40 yd. Ten minutes before this, Capt. Clayton had reported that if it were not possible to land at London he would advise diversion to Blackbushe or Hurn. He was informed that the visibility at Hurn was 1,000 yd and acknowledged this message. From the moment that contact was established with London Approach Control until less than half-a-minute before the crash, the continued conversations between London Approach Control, London Director, the Talk-down Controller and the pilot were recorded. The Court's account of the events leading to the accident was largely based on transcriptions from these recordings.

The pilot informed London Director that he wished to carry out a G.C.A. and, having been identified, "Peter Nan" was told that she was clear to descend to 1,500ft for a straight-in approach on Runway 28. During this approach—which appeared perfectly normal—the pilot was reminded that the "break-off" height for this runway was 140ft and that the Calvert lighting system was switched on. When "PN" was 11 miles out from touch-down, the Talk-down Controller took over the aircraft and the approach proceeded normally until "break-off" height was reached 400 yd from the end of the runway. The "talk-down" continued for a few seconds and then the pilot announced that he was overshooting. There was then a pause of some 4½ sec before the sound of the first crash was heard.

In his report, Sir Walter Monckton says that although it was clear that "PN's" approach was normal and well-conducted down to the "break-off" height, it was impossible to establish precisely what happened after that moment. The G.C.A. operators saw that the machine was rising above the glide-path and were confident that the pilot intended to overshoot. A few seconds later, with undercarriage retracted and with throttles set to give rated power, the aircraft struck the runway, skidded 140ft, damaging its airscrews as it did so, became airborne again and finally came down 3,000ft further on. The starboard wing was torn off and the machine came to rest alongside a pile of drainpipes, where it burst into flames.

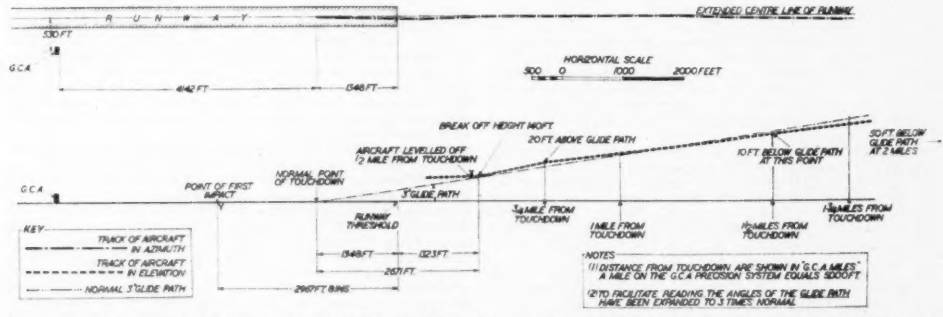
Sir Walter Monckton considers that the accident would have been avoided if the pilot had not brought his aircraft as low as he did in spite of the information several times supplied to him that the visibility, as measured on the ground, was as low as 40 or 50 yd. He is of the opinion that such an accident is unlikely to occur again if it is made an offence for a pilot to descend to so low a height when visibility reported from the ground is seriously lower than the prescribed minimum.

The relevant statutory requirements in force at the time (the A.N.O., 1949), specified that an aircraft should not continue its approach to land beyond a point at which the limits of the meteorological minima for landing were specified in the Operator's Manual. Several questions were debated at the inquiry on the construction to be placed on these words, but the Court held that a pilot would, in fact, be infringing the operator's minima in descending below 200ft (although the "break-off" height actually was 140ft) and in flying below 200ft with a visibility of less than 600 yd.

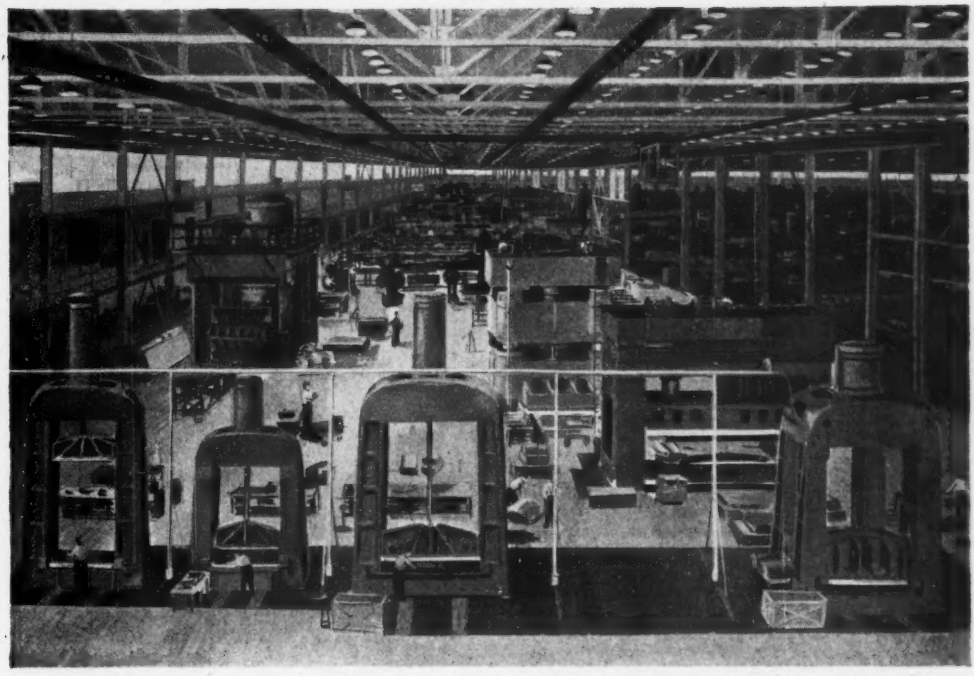
Sir Walter points out, however, that this view has to be qualified by further considerations. One of these concerns the method in use at the time to determine visibility; that is to say, whether the value should be that of forward visibility measured on the ground or by the pilot from his cockpit. In practice there is, of course, a considerable difference between these two values. Although in cases of investigation of landings carried out in conditions below the minima the pilots have always been able to see much more than the ground measurements indicated, the Court considered that the yardstick intended by the requirements should be measurement from the ground. The report goes on to say that in October, 1950, the B.E.A. Operator's Manual did not specify the minima as absolute, or unqualified, limitations. There was provision that they should be capable of interpretation by the captain of the aircraft, who could assess the existing conditions as given by the combination of the two factors and decide whether the difference produced better or worse conditions. Sir Walter indicates a further complication in the fact that at the time of the accident there was a radiation fog which might have extended to 40ft, 100ft, or even 200ft. In these circumstances he feels that although the descent from 200ft to 140ft may have involved a breach of regulations, such a breach, if established, could not involve a reflection on Capt. Clayton, since he was not infringing the instructions of B.E.A. as both he and they understood them.

Of the immediate cause of the accident, the report says that at the "break-off" point some, if not all, of the high-intensity lights on the runway were probably visible from the cockpit, and in such circumstances it would not be surprising if the co-pilot told the captain that the runway lights were visible. This would suggest to him that it was practicable to continue the approach and attempt a landing. Capt. Clayton might well have looked away from his instruments out of the cockpit and immediately entered the fog. There was no evidence of airframe failure and there was only a remote possibility that there could have been a failure of the hydraulic pipelines from the flap-operating jacks to the

(*continued at foot of page 519*)


RUNWAY
EXTENDED CENTRE LINE OF RUNWAY
530 FT.
G.C.A.
4142 FT.
1348 FT.
HORIZONTAL SCALE
500 0 1000 2000 FEET
BREAK OFF HEIGHT 140FT.
20FT. ABOVE GLIDE PATH
AIRCRAFT LEVELLED OFF ½ MILE FROM TOUCHDOWN
10FT. BELOW GLIDE PATH AT THIS POINT
50FT. BELOW GLIDE PATH AT 2 MILES
POINT OF FIRST IMPACT
NORMAL POINT OF TOUCHDOWN
3° GLIDE PATH
RUNWAY THRESHOLD
¼ MILE FROM TOUCHDOWN
1 MILE FROM TOUCHDOWN
1½ MILES FROM TOUCHDOWN
2 MILES FROM TOUCHDOWN
KEY
TRACK OF AIRCRAFT IN AZIMUTH
TRACK OF AIRCRAFT IN ELEVATION
NORMAL 3° GLIDE PATH
1348 FT.
1323 FT.
2671 FT.
2960 FT. RUNS
NOTES
(1) DISTANCE FROM TOUCHDOWN ARE SHOWN IN "G.C.A. MILES". A MILE ON THE G.C.A. PRECISION SYSTEM EQUALS 1000 FT.
(2) TO FACILITATE READING THE ANGLES OF THE GLIDE PATH HAVE BEEN EXPANDED TO 3 TIMES NORMAL

A diagrammatic reconstruction of the final approach of Viking G-AHPN to Runway "28" at London Airport. The last point in the flight at which the position of the aircraft could be ascertained with certainty is marked X. The spot marked Y is its first point of contact with the runway.



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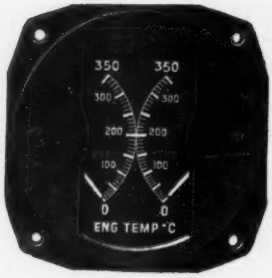

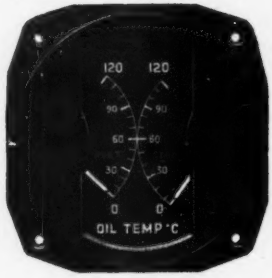

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CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

More Appropriate

YOUR correspondent, "Eagle Observer," who noticed a Prince at Luton with the unfortunate registration PP-NBG, may be interested to know that this was the machine shown in this year's S.B.A.C. show.

However, for this occasion it acquired the new registration G-AMMB—this, I presume, was "much, much better"!

Birmingham 5. JOHN A. BAGLEY.

Fire-power

MAY I endorse your editorial comment expressing concern at what appears to be an "overlong retention of the 4 x 20 mm gun formula"?

The superb flying performances put up at Farnborough only help to emphasize that in any future aerial warfare the length of time that weapons can be brought to bear is likely to be very short indeed. Therefore, lethal fire-density and accurate sighting arrangements are essential.

The combination of the gyro-compensated sight and the absence of a bulky piston engine in front of the pilot (what a lovely bit of protection it was) should enable accurate shooting at big angles of deflection to be effective over distances very much greater than in the past war, when kills were seldom achieved from any position other than "right up" astern. (I crave the pardon of the well-known character who, from the requisite angle-off, regularly lacerated the C.G.S. drogue with his one-gun (.303) Martinet, when flying upside down over the Wash!)

In arriving at a suitable armament formula for the latest high-performance gun-platforms that future R.A.F. pilots may be called upon to exploit, the many and varied roles that Fighter Command is likely to have to fulfil should be borne in mind. Tactical support to ground forces demands specialized weapons (and armour protection), with emphasis on rockets and heavy-calibre armour-piercing shells, while home-defence fighters need guns that fire H.E. shells to blast destructive holes in the bombers that may be carrying the atom bomb.

These two roles, chosen at random, show that an "e" should really go on the end of formula, so that flexibility of armament will make Fighter Command aircraft versatile and effective in all forms of offence and defence.

East Horsley, Surrey. J. C. R. WATERHOUSE.

Removing Emergency Aids

AS one who has never understood the workings of the technical mind I have always accepted developments at their face value on the assumption that they must offer practical benefit to someone. However, two recent moves appear to me to be retrograde steps and I shall be pleased if any readers can offer explanations.

I refer firstly to the present policy of removing fuel pressure warning lights from modern piston-engine aircraft. These have been blanked off in a number of types, but from the pilot's viewpoint (and they were fitted solely for his use) they represent one of the most useful aids to safety found in any cockpit.

On many occasions a warning light has glowed during the initial stages of take-off and an accident has been averted by the immediate closing of throttles while a healthy quantity of runway still lies ahead. Without this guide to fuel starvation, however, the pilot's first knowledge of any trouble is the complete death of an engine, perhaps at the critical moment just after unsticking and before assymetric safety speed has been reached. In certain types this could easily prove fatal and must almost inevitably lead to complete write-off of the aircraft.

The second point concerns emergency operation of V.H.F. sets. Those most generally in use, namely the TR 1143 and 1430, usually operated by a press to transmit button on the control column, have also a lever on the selector box with positions for "transmit" and "receive" for use when the normal method fails. However, sets issued recently have those levers screwed into a small inverted cone and fixed in the "normal" setting. Therefore, a faulty connection in the wiring to the "transmit" button places what is probably a perfectly sound set unserviceable for the remainder of the flight.

Proof that there is some definite policy behind this move is borne by the fact that the latest TR 1934/35 combination sets, providing up to 20 channels, have no emergency method of operation incorporated in the design.

When it is remembered that some aircraft have no navigational aids other than V.H.F. it is essential that the equipment provided should be operable under all reasonable conditions, for in dirty weather where, perhaps, a controlled descent is required in order to reach home safely, whether one does so or not may well depend on this factor alone.

Surely, some explanation is necessary?

Windsor, Berks. DAVID H. OGILVY.

LESSONS FROM AN ACCIDENT (Continued from page 518)

restrictor valves, which could cause the flaps to retract rapidly.

The Court suggests that, although it cannot be established with certainty, it seems most likely that Capt. Clayton deliberately came down below "break-off" point and then, at 100ft or less, entered the fog. Not until then was the overshoot procedure started. It will be recalled that the pilot announced on R/T that he was overshooting about 5 sec before the impact. The aircraft's mean speed of approach was estimated at about 99 kt. A descent into fog would have abruptly reduced the range of visibility and would have introduced singularly deceptive visual conditions.

The Court's first recommendation was that Article 17 (para. 11) of the A.N.O., 1949, should be further amended so as to prohibit aircraft from continuing their approach in circumstances in which the weather report from the ground is below the operator's minima by a certain percentage.

The second recommendation is that clarity and simplicity should be introduced into those parts of the Operator's Manual which specify the minimum height and visibility. At the time of the accident the relevant passages of B.E.A.'s Manual were neither clear nor easy to interpret. The report points out that B.E.A. do not seek to put the blame on Capt. Clayton. Nevertheless, with the regulations and the manual in the form in which they stood in October, 1950, Sir Walter Monckton does not think that B.E.A. could have effectively maintained the necessary flight supervision.

It would be necessary, he says, for both the M.C.A. and the operators to keep records of landings made in conditions which appeared to be below the minima, and thus infringed the regulations. Sir Walter does not think that individual operators need send a representative to the control tower so as to be in a position to give advice or orders to divert when conditions are below the minima, nor does he feel that specific recommendations should be made regarding the appropriate system of flight supervision to be exercised by operators, whose duty and responsibility it must remain to ensure that their pilots abide by the established minima. Similarly he thinks it unnecessary to lay down specific rules compelling pilots who have landed in conditions which they found hazardous to report this fact to other pilots still in the air. In conclusion, he points out that much of the evidence submitted during the investigation pointed to the necessity of implementing Lord Brabazon's Report on Weather Minima as soon as possible.

It is, of course, regrettable that such a tragic incident should be the means of emphasizing any shortcomings in regulations pertaining to the safety of civil aircraft. Nevertheless, the fact remains that this very thorough investigation, conducted by an eminent legal authority, has done much to improve the standards of flying safety, which, in this country, were already commendably high.

In point of fact, all of the recommendations contained in the report have been, or are about to be, implemented. There is, however, a difficulty in arriving at the precise arrangement by which the G.C.A. talk-down controller would inform a pilot that he has reached the "break-off" height. These heights vary for different operators, and if the responsibility for this action is to be left to the controller, there would be a risk of introducing a possibility of human error which does not now exist.

Lord Brabazon's recommendations on "runway visual range" measurement were brought into force on September 14th and the necessary equipment has been installed at all hard-surface M.C.A. airports.

CIVIL AVIATION

LINE-UP AT LYDDA: Part of the story of the remarkable growth of international air traffic to Israel in the past few years is illustrated by this recent photograph of the parking apron at Lydda Airport, near Tel-Aviv. DC-4s and DC-6s of Swissair, K.L.M., L.A.I. and S.A.S. are to be seen among the numerous airliners which share the heavy traffic brought about by the rapid development of this "new" country.

AER LINGUS v. THE RAILWAYS

AN extract from a recent editorial in the *Railway Gazette* would appear to indicate that at last the railways are having to admit to feeling the thin end of the proverbial wedge which short-haul air traffic is attempting to drive into the revenues of surface-transport companies. The extract reads: "It was announced last week by Aer Lingus that, as from October 21st, 17-day excursion rates, at reductions ranging from 3½ to 11 per cent, are to be introduced. From the railway point of view these excursion rates will be highly competitive, at least with the first-class fares charged for the monthly return tickets of the main L.M.R. London-Dublin route via Holyhead and Dun Laoghaire. From London to Dublin the Aer Lingus rate will be £9 18s. The London-Dublin first-class monthly return fare is £8 7s. 7d. This, however, takes no account of the incidental expenses incurred on the journey. Porterage, meals in the train, cabin accommodation in the ship and so forth, are additional items which can easily account for the monetary difference in the two fares. From the viewpoint of 'business' travellers the time saved in the journey between the two cities (4 hr by air, 10½ hr by rail and ship) may well make possible substantial economy. During the winter months some of the delays and irritations to which railway travellers on this route have been subject probably will not occur, and winter weather conditions may not be so favourable to air travel. Nevertheless, it is on routes such as this, involving a sea crossing, that British Railways would be well advised to take very seriously the competitive power of air transport."

As the load-factors currently being achieved by Aer Lingus on the trans-Irish Channel routes to Dublin will testify, it is indeed a noticeable fact that more and more passengers on these routes are trying out the benefits of the air crossing and, having sampled it once, remain in most cases confirmed air travellers. The implications contained in the "Railways' opinion" quoted above that weather conditions in winter tend to reduce the comforts of the air crossing are surely refuted by the fact that Aer Lingus' load-factors remain high throughout the year. The regularity achieved, too, is almost comparable with that of surface transport.

RECORD U.K. TRAFFIC IN JULY

STATISTICS published by the M.C.A. showing the activity of United Kingdom and Channel Island airfields during July reveal that more passengers were handled than in any previous month. The total (359,974) was 7.3 per cent more than in the corresponding month of the previous year. Freight on- and off-loaded during the month increased by 48.7 per cent over last year's figure to 5,203 short-tons.

The number of air transport movements recorded actually showed a decrease of 11.2 per cent, a general indication that aircraft of larger capacity are now being used.

London Airport recorded 3,901 air transport movements and handled 97,834 passengers—increases of 48.3 per cent and 61 per cent respectively as compared with July last year. At Northolt, movements decreased by 18 per cent to 4,746; 92,360 passengers were handled or 5.9 per cent fewer than in July 1950. London Airport and Northolt together recorded an increase of 2.7 per cent in air transport movements and an increase of 6.3 per cent in the number of passengers handled as compared with last year's figures.

Renfrew (Glasgow) was the next busiest U.K. airport for passenger traffic (22,543 passengers) although this was 12.8 per cent below the figure for July, 1950. Ronaldsway (Isle of Man) handled 20,739 passengers, and Nutts Corner (Belfast) 20,069. The popular Channel Island holiday resort of Jersey showed the remarkably high total of 33,886 passengers handled at its airport during the month.

THE "PROTEUS" HERMES

A RECENT announcement by Handley Page, Ltd., discloses some of the performance figures which it is hoped to achieve by re-powering the Hermes V turboprop airliner (Bristol Theseus) with the more powerful Proteus. Two Theseus-powered Hermes have been built, and one of these recently flew from London to Paris in 43 min. This version is not going into production and future Hermes will be equipped with the Proteus and re-designated Hermes VBs.

The increase in available horse-power amounts to nearly 3,000. The airframe will be basically the same as in the earlier versions, but the VB will have a slightly greater wing-span to allow for the larger diameter of the airscrews. All-up weight will be increased to 100,000 lb. Like its Theseus-powered forebear, the VB will have double-slotted flaps to facilitate take-off and landing from high-altitude airfields in tropical climates. It is designed to have a "take-off to 50ft" run of 1,360 yd at gross weight in I.C.A.N. plus 15 deg. C. atmosphere. Landing at sea-level (at 83,000 lb, speed 119 m.p.h.) the ground run will be 1,035 yd.

The estimated range for maximum payload at 360 m.p.h. is 2,760 miles, and payload for a 3,000-mile stage is 15,200 lb; payload with full tanks is 12,650 lb. It is calculated that on a stage of 1,500 miles, against a head wind of 60 m.p.h., the VB would cruise at 370 m.p.h. and, allowing fuel for a two-hour stand-off, and with consideration for engine maladjustment, airframe deterioration, and fleet variability, the payload would amount to 17,000 lb. and block-to-block speed would be 302 m.p.h. With 231 lb taken as the standard weight of a passenger and his luggage, the Hermes VB would not only carry 60 passengers in its cabins, but also a freight load of over 3,000 lb in its pressurized holds.

FREIGHT RATES AND CHARTER DIFFICULTIES

NEARLY all freight rates for goods carried by scheduled lines to any part of the world were increased by an average of 10 per cent on October 16th. Additionally, the minimum charge for shipments was raised. Closely linked with these developments are the charges for handling freight on the ground, Customs clearance and road transport to airports—and these have also been increased considerably.

Although there has recently been a tendency for charter quotations to rise, the increases have not been as much as 10 per cent. Increase in charter quotations is normally brought about by the gradual rise in operating expenses, but is also governed largely by the availability of aircraft, which, at the present time, is very poor. As far as the operators are concerned, it has been an owners' market for some time, and most charterers have been forced to pay amounts considerably in excess of their own ideas.

Coupled with the shortage of charter aircraft there is also a current shortage of aircrews. In the past few months this has hindered numerous fixtures, as it frequently happens that aircraft have become available for short periods, but have had no crews to fly them. A number of Halifaxes have been available all the year in this country, and, according to brokers' reports, could have taken many of the heavy freight loads which have been on

the market but for the fact that all the crews capable of flying this type were being used on Yorks operating shorter flights on behalf of the R.A.F. It is interesting to note that two new companies were recently formed in London with the object of supplying free-lance crews on a hire basis to charter operators.

AIR BEEF'S THIRD SEASON

THE third season of successful operations by Air Beef, Ltd., in the Kimberley country of N.W. Australia, has just ended. A.N.A.'s project manager (and incidentally the man who inaugurated the scheme) reports that the company's Bristol Freighters ferried some 3,124,986 lb of beef and hides from Glenroy to the Windham meat works. This entailed a total aircraft mileage of 82,235.

Although articles on the Air Beef scheme have appeared in *Flight* from time to time, it is still remarkable to be reminded of the fact that, whereas before the airlift was started the stock route from Glenroy to Wyndham was 300 miles by road and took 30 days to accomplish, the air distance is 183 miles and the flight time 1 hr 15 min. To date the operations have proved an unqualified success, but the future of the scheme will depend largely on the attitude of the Commonwealth Government, since it is now considered that further development of the scheme is too big a matter for private enterprise to handle. Assistance is being sought in the form of either a direct subsidy or a Government contribution to the erection of killing centres in the cattle-rearing areas.

TRAVEL AGENTS GO TO SCHOOL

A NOVEL series of training courses, introduced by B.E.A. for the booking staffs of travel agencies, is said to be meeting with enthusiastic response. The object of these courses, each of which lasts a week, is to give travel agents' employees a comprehensive insight into what goes on behind the scenes of an airline. B.E.A. are convinced that its agencies will be better equipped to handle their services if they possess as much background information as possible.

Between now and the middle of December about 300 booking clerks will leave their counters throughout the United Kingdom and will spend a week with B.E.A. in London. Classes of between 25 and 30 "students" will be informed on such matters as airport control procedures, aircraft maintenance, schedules, space control, traffic handling, international regulations and aircraft catering.

PAN AMERICAN LOOKS AHEAD

RE-AFFIRMING Pan American Airway's projected programme to operate Atlantic tourist-class services next spring, the airline's president, Mr. Juan Trippe, expressed the opinion, recently, before a meeting of the Foreign Traders' Association in Philadelphia, that low-cost travel of this type could treble the present American tourist expenditure abroad. Two million Americans, he said, spent approximately one billion dollars overseas in 1950.

He thought that four million additional tourists would go abroad if they could afford it and he believed that the goal of three billion tourist dollars spent abroad annually could be reached during the next few years. He pointed out that tourist-class services, even when they were run in parallel with first-class flights, had developed a substantial amount of new traffic wherever they had been inaugurated.

In the first five months of operation of the world's first tourist service—between New York and Puerto Rico—Pan American trebled the number of passengers on this route without any adverse effect on first-class revenues.

BREVITIES

THE Minister of Civil Aviation, Lord Ogmore, left London Airport on October 10th for an informal three-day visit to the Netherlands. He met various Dutch ministers and leading personalities in civil aviation, and also inspected Schiphol Airport. During his tour he expressed disappointment at the lack of interest among European airlines in new British jet and turboprop aircraft.

* * *

The D.H. Comet on loan to B.O.A.C. left London Airport on October 10th for its first flight to the Far East. It reached Cairo (2,235 miles) in 5 hr 28 min, flew from there to Karachi (2,251) in 5 hr 9 min, Karachi to Bangkok (2,362) in 6 hr 6 min, and Bangkok to Singapore (900) in 2 hr 25 min. Chock-to-chock time was thus 19 hr 8 min, while elapsed time was 24 hr 51 min.

* * *

It is understood that negotiations are in progress between the French Air Ministry and the S.N.C.A.S.E. factory with a view to using a number of S.E.2010 Armagnac transports for troop-carrying purposes. If this plan materializes it is thought that the fleet would be maintained by Air France.

* * *

The New Zealand Civil Aviation Department discloses that more than 170,000 acres of pasture land were treated by aerial topdressing in the three months ended July, 1951, as compared with 57,000 acres for the corresponding period in 1950. Some 24 companies flew 6,000 hr in these operations and spread over 22,000 tons of top-dressing material. Since the beginning of last march more than 300,000 acres have been treated.

* * *

Following the recent landing by a young Swiss pilot on the 14,000ft peak of Mont Blanc, the veteran airman, M. François Durafour, who first attempted this feat 30 years ago, has announced that he will now endeavour to repeat the exploit. M. Durafour, at 63 years of age, is the oldest surviving pioneer of Swiss aviation.

* * *

"Starlight" reduced-fare night-flights which have been carried out by Central African Airways between Bulawayo and Johannesburg this summer have (as mentioned by a contributor a fortnight ago) proved very popular. Accordingly C.A.A. intend to reintroduce them next year, probably in April or May.

* * *

The 400ft extension to the main runway at Prestwick Airport will be completed by November 1st and the full 7,000ft will then be in use. In announcing this, the Scottish Aerodromes Board also mentioned the fact that a new £15,000 terminal building is to be erected at Grimsetter Airport in the Orkneys. Work will begin before the end of the year.

* * *

Improvements in the R/T services for the handling of air traffic between Canada, Bermuda and the West Indies are announced by Cable and Wireless, Ltd. A new radio teleprinter circuit is now operating between Bermuda and Montreal in parallel with the cable circuit, and the Jamaica-Nassau radio-telegraph circuit was replaced by a similar circuit between Bermuda and Nassau on September 15th.

* * *

According to the *New York Journal of Commerce*, the cheap-rate transatlantic airline traffic which may be in full swing by next summer will threaten passenger shipping on the lucrative North Atlantic route with serious competition. The cabin and upper-tourist class accommodation, particularly, is likely to suffer, the *Journal* says, if it is found possible to operate tourist flights between New York and London for $250 or less.

* * *

The Irish Deputy Prime Minister, Mr. Sean Lemass, disclosed in Dublin last week that the idea of an Irish transatlantic air service has not been dropped and that new investigations are now under way. He also mentioned Aer Lingus' plans for additional services to Britain, including one to Edinburgh. The company, he said, has been encouraged to extend its operations to Scotland by the satisfactory growth of the Glasgow services which began in 1949. In one week in July as many as 2,184 passengers flew on the Dublin-Glasgow run.

SAME HORSE—NEW TRAINER: The first of the new Auster Aiglet Trainers —actually the machine which was so convincingly demonstrated at Farnborough by pilot Porteus—was recently sold to an overseas buyer. The Trainer, as its name implies, is a suitably modified and strengthened version of the type which is proving popular with private owners.

PROBLEMS of the JET ERA

Sir Frederick Bowhill Sums Up the Commonwealth Conference on Jet-Airliner Operation

LAST week we published a brief summary of the main conclusions reached at the Commonwealth *ad hoc* meeting on the operation of turbine-powered aircraft, which took place in London from September 25th to October 5th. Sir Frederick Bowhill, chief aeronautical adviser to the M.C.A., was in the chair throughout the meeting. The conference itself was held mainly as a secret session, and consequently no official transcript is available of the delegates' deliberations. We have, however, received Sir Frederick Bowhill's personal summing-up of the highlights discussed, and this provides a lucid picture of the ground covered.

Sir Frederick found that the conference, as a whole, was vitally aware of the importance of communications for air transport. The outstanding requirement in this field, he says, is for greatly improved point-to-point communications. He believes that the discussion emphasized the following points: (*a*) That because V.H.F. R/T. (and V.H.F. D/F.) has a potentially greater range for high-altitude aircraft, it may become possible to provide complete cover on long overland routes; (*b*) that the interference problem is accentuated and that every support should be given to an early increase in the number of V.H.F. R/T. channels to be used in congested areas, and to the provision of additional channels as a special measure for high-flying aircraft, as and where the problem becomes acute; and (*c*) that R/T. discipline in the V.H.F. band should be improved.

Dealing with the subject of fixed telecommunications, he says that the conference made it clear that the introduction of the Comet and similar aircraft will expose the deficiencies of the present services. There is a serious danger of aircraft arriving before the signals referring to them, or that information will arrive too late to be of use by aircraft or ground station.

Because of this, it is vital that there should be a speed-up of implementation and an early completion of detailed plans. (In the U.K. an extensive programme of teletypewriter conversion on circuits terminating at this end is now under way and a modern national Signals Centre is also being built.)

Sir Frederick considers that the main conclusions to be drawn are (*a*) that all staging posts for gas-turbine aircraft should be interconnected by teletypewriter, preferably on landline, but alternatively using radio links, and with some form of tape-relay facility; (*b*) that there must therefore be early implementation of the internationally agreed plan, otherwise it will be necessary temporarily to deviate from it and provide direct circuits; (*c*) that the greatest weakness in the present system is in the time taken for handling messages at stations. (This, he suggests, could be improved by the use of electronic or mechanical links within the station, by training of staff, and by careful layout of the Signals Centre); and (*d*) that in certain special circumstances H.F. R/T. might be useful for fixed services, for example, in cases where direct communication is essential but telephone tie-lines cannot be provided. The serious world-wide shortage of radio frequencies would, however, prevent any great extension of this system.

Sir Frederick points out that the United Kingdom favours the general introduction of long range H.F. R/T. along the main trunk routes, although the transition from H.F. W/T. to H.F. R/T. is expected to take several years.

The Meteorological Aspect

The importance of efficient meteorological services to the success of operations by turbine-powered aircraft were stressed during the conference. It is apparent, says Sir Frederick, that more detailed information on hourly changes of surface wind and temperature at international airfields is required in order to select the period of optimum conditions for aircraft departure. An appreciable advance in upper-air forecasting cannot be expected until the existing network of upper-air reporting stations is improved and all meteorologists have had the opportunity to check the application of existing forecasting techniques or to develop more effective ones. There is a particular need for accurate data between the height of 30,000ft and 50,000ft, and it is therefore essential that the world-wide radio sonde network recommended by I.C.A.O. be established at an early date.

Because of the reduced accuracy of observations at high levels, research is required into the development of instruments to give more accurate readings than are possible at the present time. It is important, also, that all operators of civil turbine-driven aircraft make a point of accurate in-flight weather reporting during the first five to ten years of operation at high altitudes.

In connection with the need for accurate landing forecasts, Sir Frederick says the conference felt that further investigation could usefully be made into the application of radar for storm detection in areas where weather deteriorations are often rapid and local and where networks of surface reporting stations are sparse.

On the implications of the navigational problem, he points out that crews must be provided in the air with quick and accurate means of determining their position. There must be a means of checking from ground speed the extent to which the aircraft has run into winds of different velocities from those forecast—an important point in relation to high-velocity jet streams. Existing types of long-distance aid do not meet the requirement satisfactorily and there is evidently a need for new development in this field.

He mentions the possibility of an aid that would be completely airborne. This, he says, would have obvious attractions to ground administrations, but there is as yet no indication that such an aid can be provided. The development of a really satisfactory long-distance navigational aid could mean that at many places—except in areas where traffic densities require a very high accuracy of flight timing and navigation—the in-flight transition from the long-distance aid to an approach aid could be made direct and without the necessity for a short or medium distance aid.

In order to begin an economic let-down from cruising altitude, an aircraft needs to know its position at up to 200 miles from its destination, and during a let-down it needs to be able to check its progress and maintain a separate flight path from other aircraft.

In this connection Sir Frederick says the delegates agreed that the immediate requirement in terminal areas can be met by V.H.F. D/F., M.F. beacons, and—most important—by 200 mc/s D.M.E. The U.K. has devoted considerable efforts to developing 1,000 mc/s D.M.E. to the I.C.A.O. specification, but there is no prospect of there being an adequate number of installations by the time the Comet is put into service. Most of the places on the Comet routes already have a form of 200 mc/s D.M.E. which was installed to meet the requirements of piston-engined aircraft. This equipment is likely to be required for about three years and probably longer, depending on the rapidity with which 1,000 mc/s D.M.E. or some other system could be installed as a replacement.

A good deal of discussion revolved round the choice between short-distance navigational aids, V.O.R. and D.M.E. and the medium-distance aid, Decca, Sir Frederick says. Arguments referred on the one hand to the cost of V.O.R./D.M.E. networks and the low accuracy of the V.O.R. component; and, on the other hand, to the possible administrative difficulties of providing Decca in certain localities. The M.C.A. has explained that it considers Decca the superior of the two systems on technical and economic grounds, and has also referred to developments of the integrated track range and track guide for use in certain areas overseas.

Integrating Jet Traffic

In considering air-traffic control problems it was accepted that no priority could be afforded to jets over other commercial air users and that it was important to achieve standardization of control procedures in order to maintain a smooth traffic flow. The features brought out by the conference were that forecast take-off clearance times should be accurately adhered to by control and aircraft, in order to reduce prolonged engine running and, therefore, heavy fuel consumption on the ground; and that the aircraft should thereafter be permitted as unrestricted a climb as possible. *En route*, the traffic-control problems were such that, since the altitudes were constantly changing, vertical separation would no longer be practicable. For descent from cruising altitude the aircraft requires freedom to conduct a steady descent, speeding it up at the end as required, rather than to be brought down too early and to have to fly level for a long time at a low altitude.

For the let-down into the approach sequence, experience at London Airport has shown that the fuel penalty involved in bringing the Comet through the conventional stack at Epsom was less than the possible delay risked by bringing the Comet down in a special procedure from 15,000ft, which would involve going through altitudes of other aircraft on the airways. However, it is very probable that, as yet more experience is gained on jets and as their numbers increase, the move will be to a different descent-pattern, although for this much better navigational aids will be required than are available today. The essential thing is to avoid delaying the jet aircraft at low altitudes.

One interesting point brought out was that the effect of utilization of high-speed aircraft necessitated a very short turn-round time, and this made it impracticable to adhere to the requirement that a full flight-plan should be filed at least 30 minutes before take-off.

The effect of temperature on turbine-powered aircraft is specially important and this fact is likely to make runway requirements critical. The concept of over-runs and the scheduling of operations in the cooler parts of the day will, it is thought, alleviate the problem at many airfields. At others, dependent upon stage length, full payload can be carried at the reduced take-off weights imposed by runway limitations. In the extreme case, however, the cost of providing extra concrete will have to be weighed against the practicability and economics of the use of some method of assisted take-off.

Much of the early discussion at the conference centred round the figure of 9,000ft as a runway length for the Comet Series I. Taken out of its context, Sir Frederick points out, this figure can be misleading. He stresses the fact that both physical and financial limits are now being reached at many of the world's more important traffic terminals, and that designers and operators should both be left in no doubt of the need to produce economic aircraft sufficiently flexible to use the largest number of airfields possible.

It is important to remember, he says, that the temperature affects piston-engined aircraft too. For example, the Stratocruiser would lose 18,500 lb in all-up weight on a 9,000ft runway at 5,000ft at I.C.A.N. plus 15 deg C.

In conclusion the much-discussed topic of turbine noise is mentioned. This affects not only the design and layout of airport buildings but also the general public living in the vicinity. All delegates agreed that very careful examination and research must be made into this important question. They were also of the opinion that investigations should be carried out to see whether there was any significant trouble to be expected from exhaust gases in the terminal areas.

SERVICE AVIATION

Royal Air Force and Naval Aviation News

R.A.A.F Chief of Staff

THE services of A.V-M J. D. I. Hardman, C.B., C.B.E., D.F.C., have been placed at the disposal of the Australian Government for appointment as Chief of the R.A.A.F. Air Staff, in succession to Air Marshal G. Jones, C.B., C.B.E., D.F.C. Air Marshal Hardman will assume the acting rank of Air Marshal and will take up his new post in January, 1952.

Much of Air Marshal Hardman's war service was in the Far East, and in 1949 he was Commandant of the R.A.F. Staff College at Bracknell, Berkshire. From the Staff College he went to Home Command, first as S.A.S.O. and later as A.O.C.-in-C.

While serving in the Royal Flying Corps in the 1914-18 war, Air Marshal Hardman was awarded the D.F.C.

"Pinnacle" Ends

POSTPONED from October 3rd, the night phase of the air defence exercise "Pinnacle" took place on the night of October 9th.

Led by a pathfinder force employing the technique of the big war-time raids on Germany, the biggest raid of the exercise had the London suburb of Tottenham as its target.

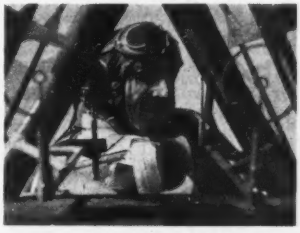
The Lincolns and Washingtons approached the Wash from the direction of Heligoland, and over King's Lynn turned south for London. The target was reached at approximately 11.30 p.m., and the attack made from heights varying between 18,000ft and 25,000ft. Night fighters, which included the new Meteor N.F.11s and Vampire N.F.10s, were sent up to intercept.

After passing over the target the bomber stream headed towards the Isle of Wight and dispersed on reaching the coast. It had been intended that the bombers—as part of their own training—should have made practice runs over the Larkhill ranges on Salisbury Plain. This part of the night's operations, however, had to be abandoned because of a forecast of early-morning fog at many of the bomber bases.

Air Chief Marshal Sir Hugh P. Lloyd, A.O.C.-in-C. Bomber Command, visited a number of his stations during the night.

Royal Tour Co-ordinator

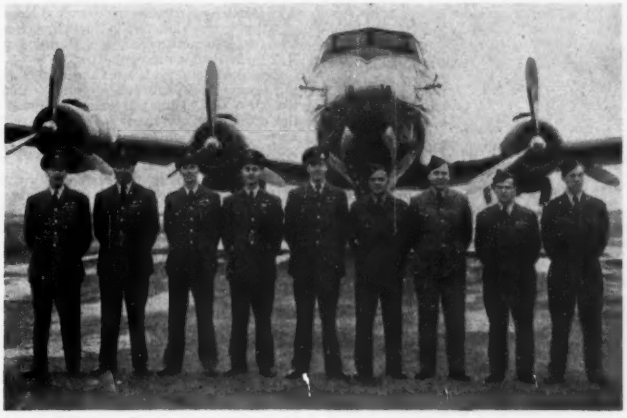
FOR the royal tour, now in progress in Canada and the United States, G/C. E. A. McNab, O.B.E., D.F.C., R.C.A.F., has been appointed Armed Forces Co-ordinator. He is travelling aboard the royal train and in the aircraft which Princess Elizabeth and Prince Philip are using for their journeyings across the continent.



"Flight photograph"

S/L. F. B. Sowrey, the new C.O. of No. 615 (County of Surrey) Squadron, R.Aux.A.F.

ROYAL CREW: The R.C.A.F. crew of the Canadair C-5 in which Princess Elizabeth and Prince Philip are travelling. (Left to right), W/C. R. I. Trickett, D.F.C., commanding officer of No. 412 Squadron, R.C.A.F., S/L. S. F. Cowan, F/L. L. W. Hussey, F/L. R. Thornycroft, F/L. K. A. Wark, Sgt. A. J. Booth, F/Sgt. Dido, Sgt. Mignalt and L.A/C. Dear.



LOOKING FOR TROUBLE: A Bristol Sycamore of the R.A.F. Casualty Clearing Unit flying over forward battle areas during this week's big exercise "Surprise Packet."

Change of Command for No. 615

REGRETFULLY, S/L. Neville Duke has had to give up the command of No. 615 (County of Surrey) Squadron, R.Aux.A.F. Pressure of work as Hawker's chief test pilot prevents his devoting sufficient time to squadron duties.

His place is being taken by S/L. F. B. Sowrey, who was the squadron's first training officer when the unit was revived after the stand-down of the R.Aux.A.F. at the end of the war in Europe. S/L. Sowrey is still a member of the regular R.A.F. and his appointment is for a period of only twelve months. It is hoped that during this period a suitable R.Aux.A.F. officer will become available.

No. 615 Squadron, of which Mr. Winston Churchill is Honorary Air Commodore, has recently been re-equipped with Meteor 8s and is the first Auxiliary unit in No. 11 Group, Fighter Command, to receive them.

W.R.A.F. Annual Conference

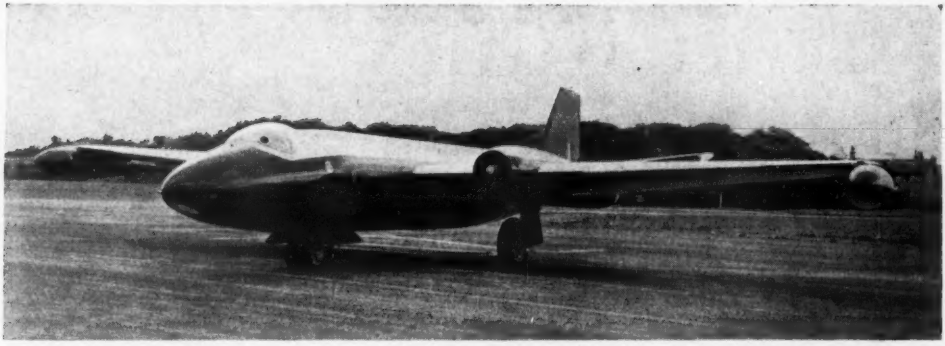
THE annual conference of W.R.A.F. officers, to be held at R.A.F. Hawkings on Tuesday, October 30th, will be opened by Air Chief Commandant H.R.H. the Duchess of Gloucester. The conference, which will last two days, will be attended by some 80 senior W.R.A.F. officers under Air Commandant N. M. Salmon, Director of the W.R.A.F.

Marshal of the Royal Air Force Sir John Slessor, Chief of the Air Staff, will address the conference.

"St. George's" Chapel Dedications

THE new St. George's Chapel of Remembrance at Biggin Hill will be dedicated at 3 p.m. on Saturday, November 10th, by the Bishop of Rochester.

The new building replaces the original chapel which, it will be remembered, was destroyed by fire in 1946. It is a memorial to 453 pilots of the Biggin Hill Sector of



CANBERRA B.5: Unlike the B.2 tactical bomber, now in squadron service, the Canberra B.5, the prototype of which is seen in this official photograph, has a "solid" nose, incorporating a large flat panel with an optically flat section at its forward end. A Canberra B.2 shared flying demonstrations at the S.B.A.C. Display with a P.R.3.

SERVICE AVIATION . . .

No. 11 Group, Fighter Command, who lost their lives. Their names are inscribed on wall panels and there is a George Room for quiet and relaxation.

All who served in the Biggin Hill Sector during the Battle of Britain are invited to attend the ceremony of dedication. Tickets may be had from the Hon. Secretary, St. George's Chapel of Remembrance, R.A.F., Biggin Hill, Kent.

Coastal Command Tie

A TIE has been produced for wear by past officers and airmen of Coastal Command. Of rayon material, it has the astral crown of the Coastal Command badge repeated on a dark blue ground. Past members should apply to the P.M.C., H.Q. Coastal Command, Northwood, Middlesex, giving details of their qualification and enclosing a remittance of 15s.

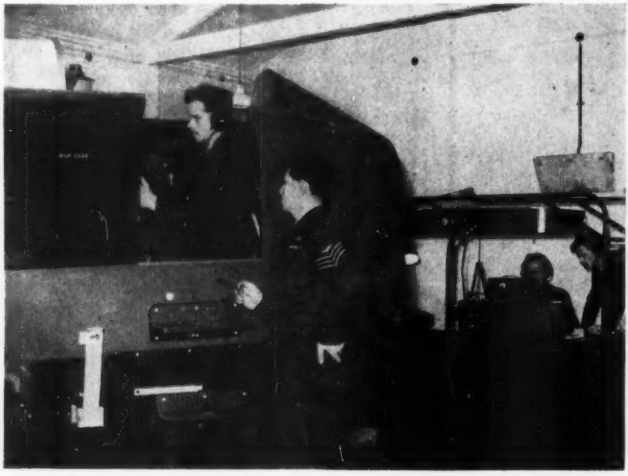
A Well-earned M.B.E.

AN M.B.E. has been conferred upon F/L. J. C. L. R. Labelle, R.A.F., who was the signaller aboard an Anson which was forced to alight on very heavy seas in the Atlantic, west of Tangier. Without prompting from his captain he originated an S.O.S. message on the W/T. and received an acknowledgment before the aircraft struck the water.

The Anson sank before the "J"-type dinghy was fully inflated, all six occupants being swept into the sea and one becoming entangled, head downwards, in a dinghy rope. Despite the fact that he was carrying the dinghy radio in one hand, F/L. Labelle assisted the captain to free the entanglement, to right the dinghy and to assist into it all but one of the crew, who was swept away.

F/L. Labelle relinquished the radio only when it was taken aboard. He then played a very full part in making the dinghy seaworthy, and for more than three hours—during which he was almost continuously sea-sick—he alternately attempted to work the radio, to bale out, and to throw himself about the dinghy in order to prevent it capsizing in the 30-40ft waves. When the craft was located by a French destroyer, he gave his captain every assistance in the hazardous operation of boarding this ship. There is little doubt, says the citation, that his bravery under very trying circumstances was instrumental in the survival of five of the six occupants of the aircraft.

IN THE LINK: Acting P/O. A. Cook, one of 170 National Service student pilots at No. 8 Advanced Flying Training School at Dalcross, Inverness-shire, has a session in the Link Trainer. The school was restarted last May and members of the first course will shortly receive their wings. The remaining five months of their period of service will be spent with the squadrons.



Winter in Korea

THE C.-in-C. British Commonwealth Forces in Korea, Lt. Gen. Sir Horace Robertson, recently visited No. 77 Fighter Squadron, R.A.A.F., to see what steps had been taken to combat the bitter Korean winter, which will soon start.

Special issues of clothing have already been made to all personnel. These include fur-lined balaclava-type helmets which cover the ears and reach down almost to the shoulders and a fur-lined inner jacket with waterproof windcheater to be worn over it. Two pairs of waterproof trousers are to be worn over the ordinary garments with calf-length leather boots. A thick scarf which will protect the face completes the outfit.

Curtis Memorial Prize

WINNER of the Curtis Memorial Prize this year is Cpl. G. R. Quick, a regular airman serving with Coastal Command at R.A.F. St Eval, Cornwall.

The prize is awarded on the results of the Forces Preliminary Examination held last May. Cpl. Quick was a Halton apprentice when he joined the R.A.F. in 1939 and served in the Middle East during the war.

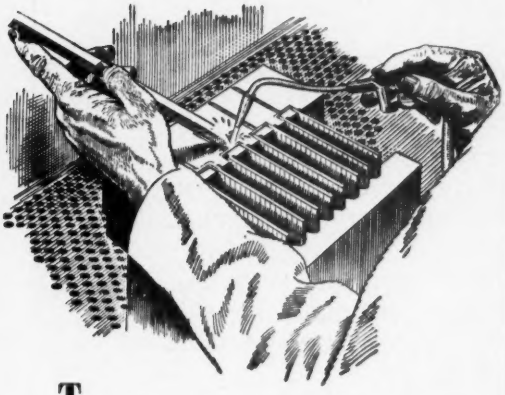
Wakefield Boxing Competitions

THE R.A.F. boxing competitions for the Lord Wakefield senior and junior novices trophy will be held at R.A.F. Henlow, Bedfordshire, on October 22nd to 24th. The senior competition is open to stations with an establishment of 750 airmen or over, and the junior for stations having less than that number.

Reunion

BRISTOL will be the venue for the fifth annual reunion of No. 2 Ferry Pool, A.T.A. to be held on Saturday, November 10th. Tickets (6s 6d) from Mr. M. Ward, The Rectory, Cheddon Fitzpaire, Taunton, Somerset.

the future in their hands . . .



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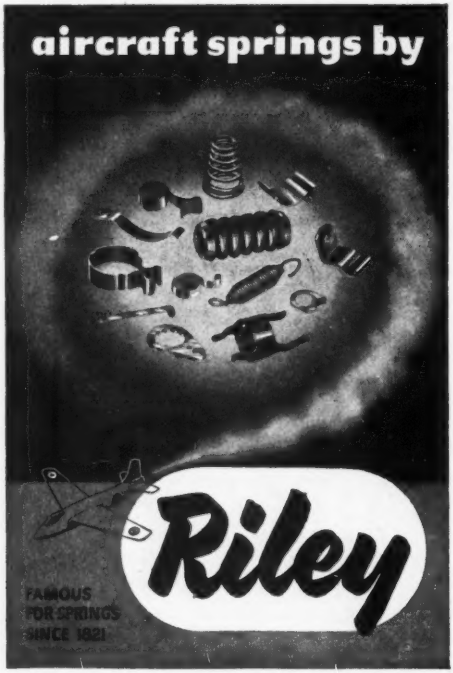

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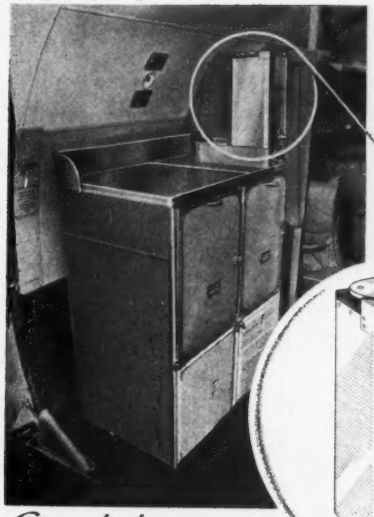

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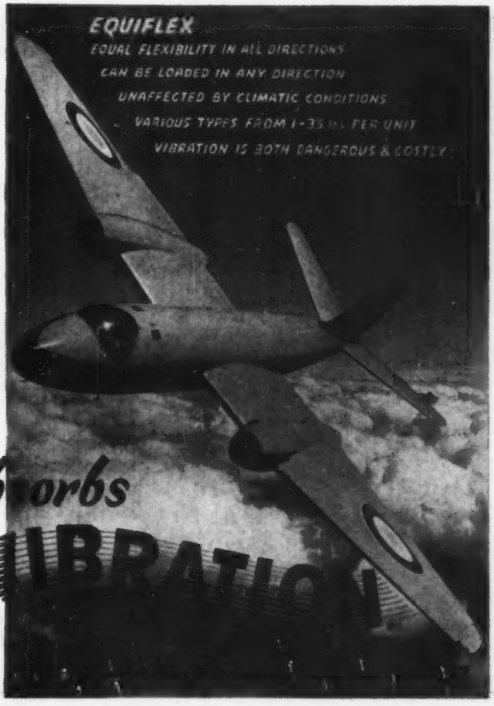
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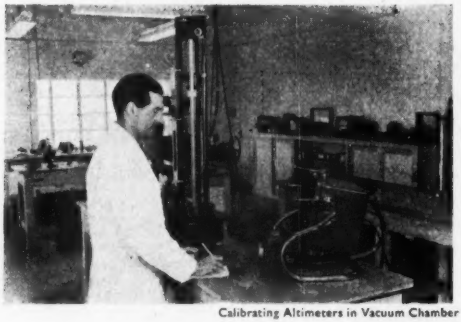

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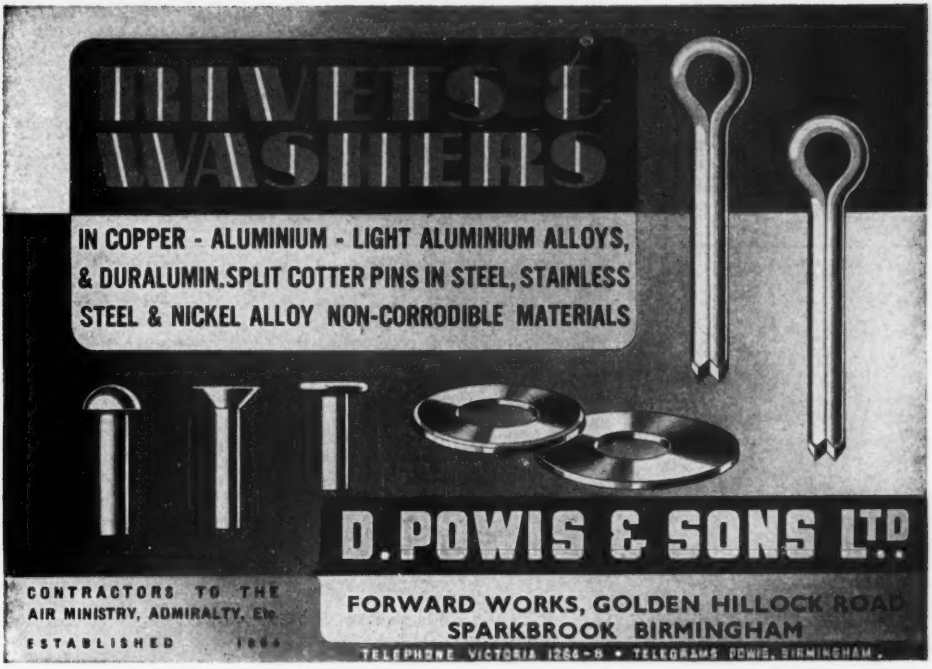
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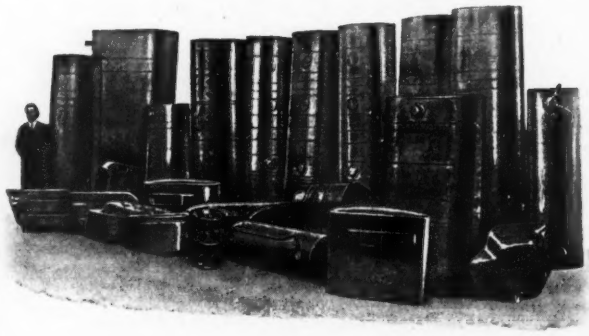

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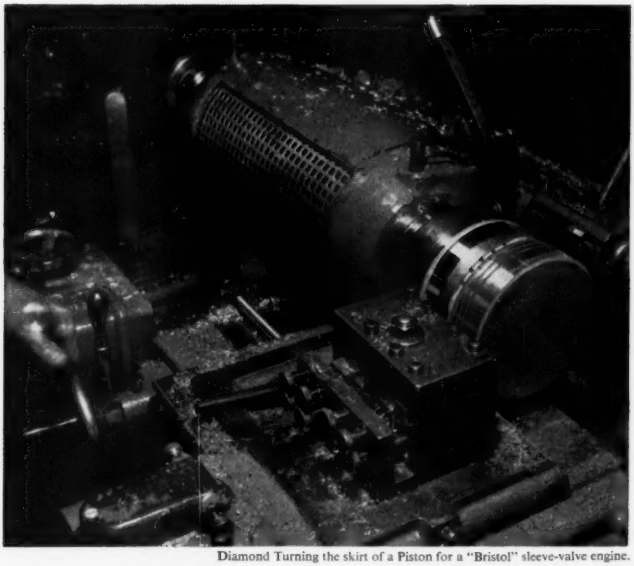

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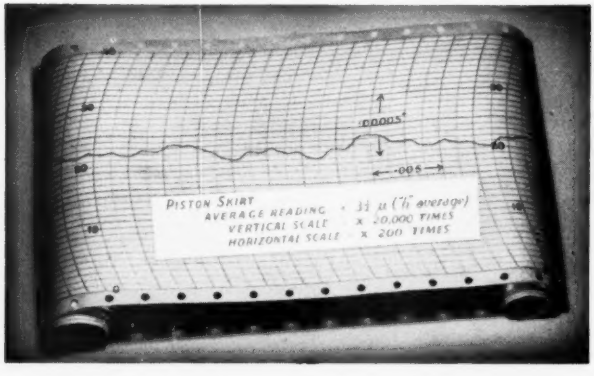

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